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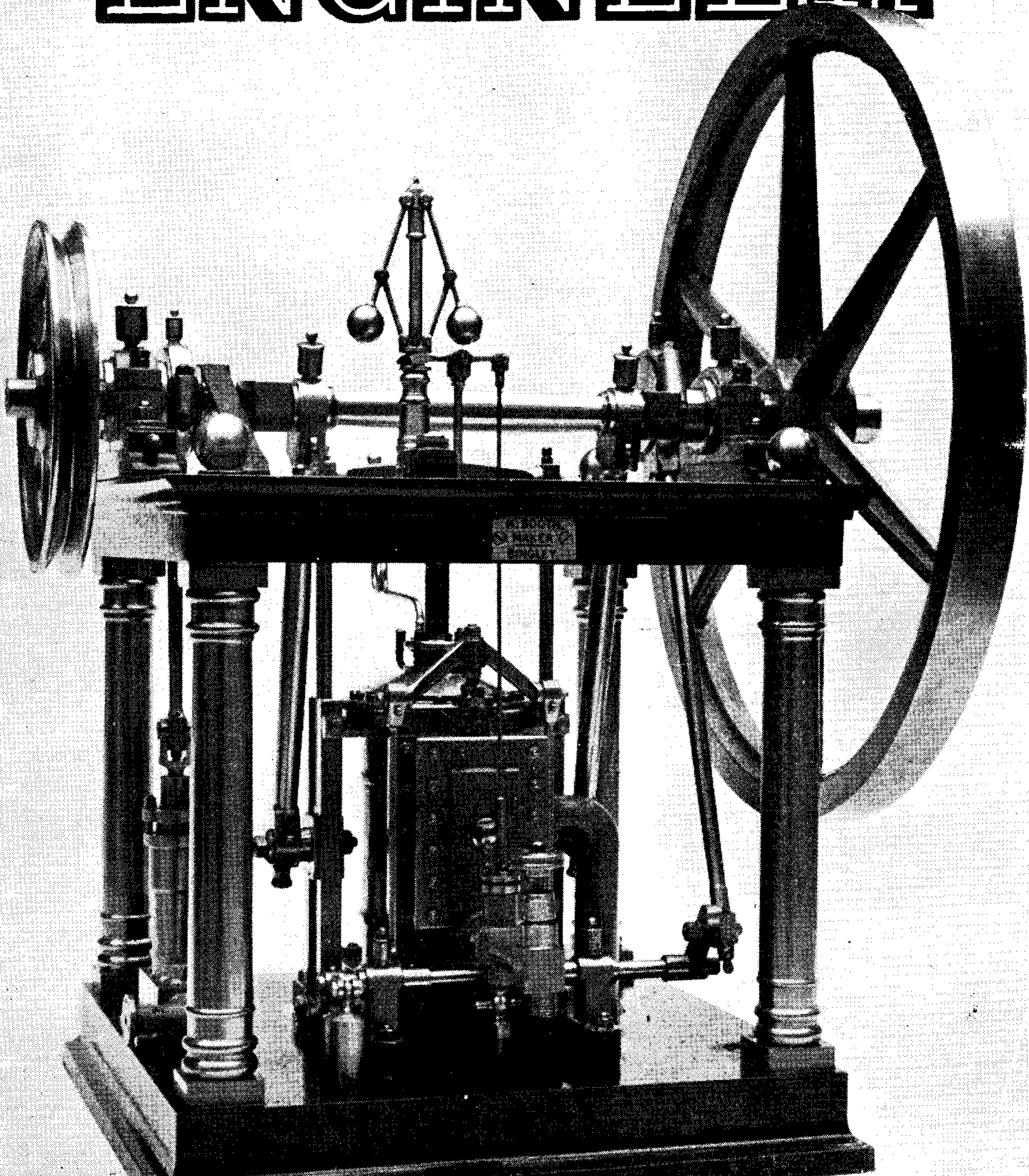
THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

17TH JULY 1952 VOL. 107 NO. 2669

SMOKE RINGS

Our Cover Picture

● THIS WEEK we show a very fine model of a low-type table engine by Mr. H. Booth of Bingley, who needs no introduction to readers of THE MODEL ENGINEER. The extraordinarily fine workmanship in evidence on this model is in keeping with the tradition of the builder, and will, we are sure, be a tremendous example to be followed by all who aim to achieve similar perfection in their hobby.

Triumph over Difficulties

● TO THOSE of our readers who consider that the space in the pages of THE MODEL ENGINEER is too valuable to be given to anything but "legitimate" model engineering (on the exact definition of which, however, hardly any two readers seem to agree!), it may seem that an article on the construction of spectacles is quite out of place. In the ordinary way, we should be of much the same opinion; but circumstances alter cases, and the particular circumstance in this case was the war, which, readers will hardly need to be reminded, uprooted millions of people from their normal occupations and led their feet into strange paths. The article by Mr. Razoux Kühr, of Amsterdam, which we publish in this issue, is one which, to say the least of it, is well off the beaten track of model engineering activity, but we hope and believe that most of our readers will agree that it deserves full well to be allotted space in our pages. The story he tells is one that should be both an example and an inspiration to those of our readers who are struggling hard against the handicaps of inadequate equipment and workshop facilities. While we appreciate in all sincerity the tribute paid to the assistance obtained from THE MODEL ENGINEER, the outstanding fact which emerges from this story is the resource, patience and independence of spirit of men who refused to give in despite apparently insuperable difficulties. In our modern civilisation, humanity tends to lose individual resource and to rely more and more on ready-made facilities. Philosophers often speculate on how the average man would fare if suddenly transported to an uninhabited region, with none of the resources of civilisation to help him in making a living. In such a test, we believe that experience gained in dealing with the many small problems and difficulties encountered every day in the model workshop would be invaluable, and though perhaps few would achieve results comparable with those described by Mr. Kühr, we have reason to believe that many of our readers would give a good account of themselves.

"Centenaries Express"

● TO CELEBRATE the centenary of the opening of Kings Cross Station in October, 1852, and the opening of the "Towns Line" between Werrington Junction and Retford via Grantham and Newark in August of the same year, it is proposed, with the kind co-operation of the Eastern Region, British Railways, to run a special train between Kings Cross and York on Sunday September 28th, 1952.

The train will be composed of open stock throughout, with two kitchen cars, and will be hauled by a Class A4 Pacific, probably No. 60022 "Mallard." It is intended that departure from Kings Cross will be at about 9.15 a.m., and it is hoped that it will be possible for the train to be run non-stop to York in approximately three hours and ten minutes, though no decision has yet been reached on this point by the Operating Department, Eastern Region. The return journey from York will start at about 3 p.m., and the return route will follow the course taken by trains prior to the opening of the Towns Line, i.e. via Church Fenton, Knottingley, Doncaster, Retford, Gainsborough (Trent Junction), Lincoln, Boston, Spalding and Peterborough, arriving at Kings Cross about 8 p.m.

The fare for the journey will be 35s. per head, to include rail fare, light refreshments served at every seat on the way down and dinner on the return run. Suitable headboards will be provided for the rolling stock and locomotive, and some sort of commemorative literature will be issued as a memento of the occasion. In addition, a special run of tickets has been printed, and arrangements have been made for passengers to retain these at the end of the journey. Arrangements are also being made for the Railway Museum at York to be opened specially in connection with the trip.

In passing, it may be of interest to recall that September 28th is only a day removed from the anniversary of the record run of the Silver Jubilee train, hauled by locomotive No. 2509 *Silver Link*, on September 27th, 1935.

Tickets are now available from :—

Mr. A. F. Pegler, "White Lodge," Rampton, Nr. Retford, Notts. ; or Mr. H. T. S. Bailey, 80, Bessborough Place, London S.W.1. ; or Mr. L. J. W. Smith, 898A, High Road, Finchley, N.12, and early application is invited, as the seating accommodation is limited to about 450. Applications for tickets should be accompanied by a stamped addressed envelope.

Another Traction Engine Race Proposed

● WE LEARN from Mr. G. Brogden, of the British Fairground Society, that another traction engine race, under the auspices of Mr. E. H. Goodey, Agricultural Merchant, Twyford, Berks., is being arranged to take place in August. The precise date and time have yet to be decided, but Mr. Brogden, on behalf of the B.F.S., is hoping to organise coach parties from London to visit the event. If any readers wish to take advantage of this arrangement, they are requested to get into touch with Mr. Brogden, whose address is 17, Millais Gardens, Edgware, Middx. as soon as possible ; he is in touch with Mr. Goodey and will send out full details to enquirers as soon as the information is available. But don't forget the stamped addressed envelope for a reply !

Noise Holds Up Progress !

● WE LEARN that yet another scheme to build a model car racing track has been banned by local authorities, after witnessing a demonstration, on the grounds that it would be too noisy. This story is becoming all too familiar, but though the devotees of competitive model sports may consider the objection to be unfair, we wonder whether they have yet fully realised that the entire future of their hobby may be jeopardised unless active and immediate steps are taken to reduce the noise of small racing engines. With the exception of the silencing rules enforced by the Model Power Boat Association, we know of no definite regulations to control the noise of engines, and the problem must necessarily become worse as efficiency improves. We have repeatedly urged club organisers to give this matter urgent and serious attention, and make no apology for another repetition of this warning.

Not so New !

● A LETTER recently received from Mr. A. C. V. Kendall, of Salisbury, Wilts, reads :

"As I am a steam enthusiast I have often idly wished that the modern pedestrian-controlled horticultural power tools were available with steam power as an alternative to i.c. engines. The comparative quietness of such implements would surely be appreciated by many.

"A recent 'Smoke Ring' (May 8th, 1952) concerning the British Light Steam Power Society gives a faint glimmer of hope that there may come a day when small steam tractors are available ; though there is a world of difference between a steam car and small horticultural machine.

"Now I find that my wish has been anticipated by some fifty years. In this year's summer issue of *The Countryman*, there is a small illustration of a Leyland steam lawn-mower, from a catalogue of 1899. The caption states that the boiler was oil-fired and that the machine sold at £85. A brief description adds that : 'It weighed half a ton and its chimney towered over the garden shed ; but you could have steam up in ten minutes, if you were lucky.'

"The illustration shows that the mower was of orthodox design and that the boiler and engine were vertical. The engine appears to have had two cylinders."

The oft-quoted old adage ; "There is nothing new under the sun" seems to apply here, once more !

A Reminder

● THIS YEAR *The Model Engineer* Exhibition will be held a little later than has been usual in recent years. It will take place from October 20th to 29th (Sunday excepted) at the New Royal Horticultural Hall, Greycoat Street, Westminster, London, S.W.1. The opening times will be from 11 a.m. to 9 p.m.

A HORIZONTAL MILL ENGINE

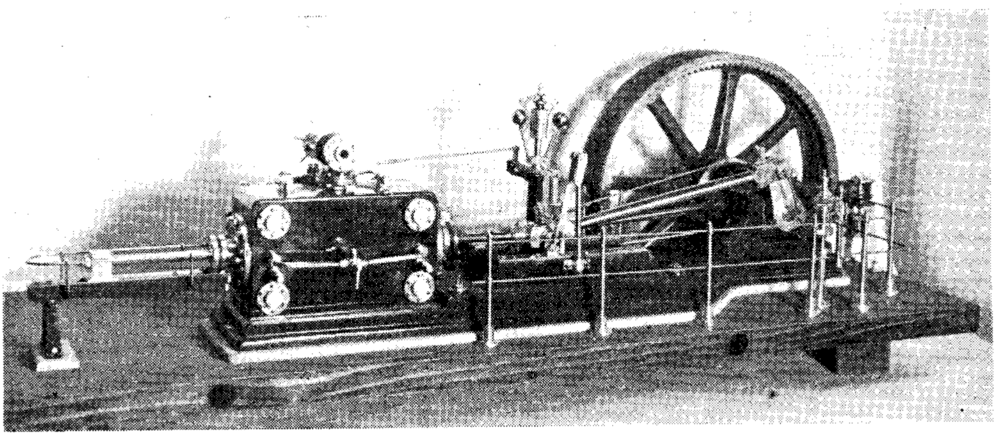
by "Northerner"

READERS may recall that the photograph on the cover of THE MODEL ENGINEER for November 15th last, featured the Corliss-geared engine exhibited by Mr. Amos Barber at the Leeds Exhibition, and that a further photograph, with a very brief description, was contained in Mr. W. J. Hughes' account of that exhibition in the same issue.

projecting from the side of the cylinder-block.

The four valves are in housings at the ends of the cylinder blocks, and are part cylindrical in section, so that as they rock back and forth on their axes the upper ones admit the steam, and the lower ones exhaust it.

Cranks on the ends of the exhaust-valve spindles are directly connected to the innermost



Photograph No. 1. This photograph, which was taken by Mr. W. J. Hughes at the Leeds Exhibition, 1951, shows Mr. Amos Barber's Corliss engine before completion. Two further illustrations appear in THE MODEL ENGINEER *dated November 15th, 1951*

wrist plate, so that as the latter oscillates on its axis, actuated by the eccentric-rod, the valves also oscillate on their spindles.

The engine was then not quite finished, but at the 1952 Northern Models Exhibition it was shown in its complete form, where it only just missed First Prize in its class by two or three marks. (The prize was awarded to Mr. R. W. Wood's Table Engine, described a few weeks ago, and the judges had a very hard task in deciding the issue, be it said !)

Valve Gear

This beautiful Corliss engine was full of detail, and the finish was really superb, without being "over-finished." The type of Corliss valve-gear fitted is Inglis and Spencer's, as favoured by Hick Hargreaves, the well-known northern builders of mill-engines. This type of gear is very pretty to watch in action, and Mr. Barber's model valve-gear is authentic in detail, with its clicking springs and release mechanism.

A brief description of the valve-gear may not be amiss, and will be useful to those readers not familiar with it. (It may be mentioned that this is only one of the very many different types of Corliss-gear.)

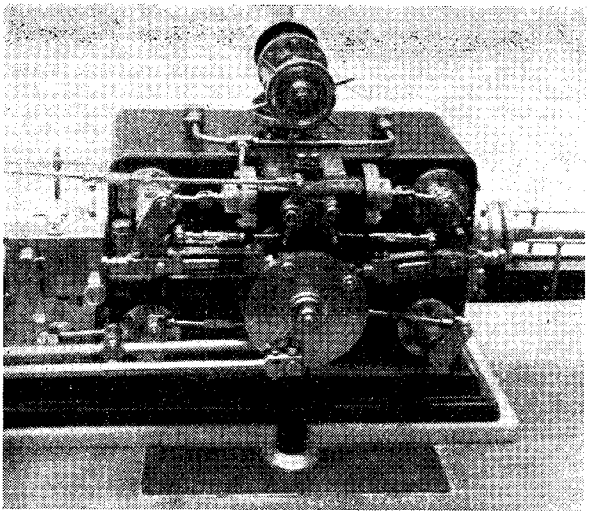
Separate eccentrics are used for the admission and exhaust, each driving a disc or "wrist-plate" mounted one behind the other on a stub-shaft

Inlet Valve Trip-Gear

The outer wrist-plate is connected to the inlet valves by means of trip-gear, and the latter in turn is connected to the governor which, by allowing the inlet valves to be closed earlier or later in the stroke, varies the cut-off and thus governs the engine.

A double-ended crank is mounted on each inlet-valve spindle, and the valve-rod connecting it to the wrist-plate is attached to the lower crank-pin. The valve-rod is in two parts, one of which can slide telescopically within the other, and they are held together by two spring clips, attached to the inner part, which engage with two corresponding shoulders on the outer part. (See rearmost valve on Photograph No. 2.)

The outer part of the valve-rod, however, is slotted just in front of the crank-pin, and in the slot is mounted a double-ended cam, which may be seen in the foremost valve-rod in the same photograph. On the same pin as the cam is mounted a lever, connected by a rod to a crank which is controlled by the governor-rod itself.

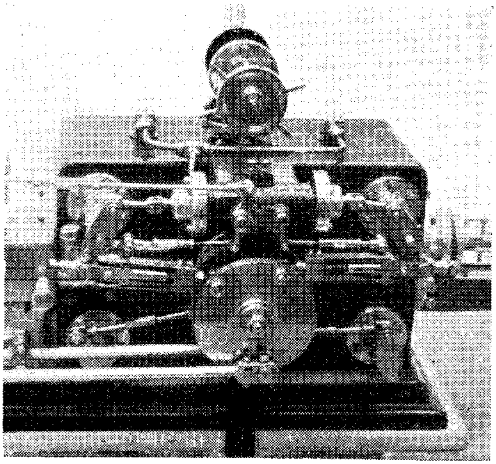


Photograph No. 2. The intricate and beautifully-made Inglis and Spencer valve-gear of the 1-in. scale Corliss engine. (*Photo by the author*)

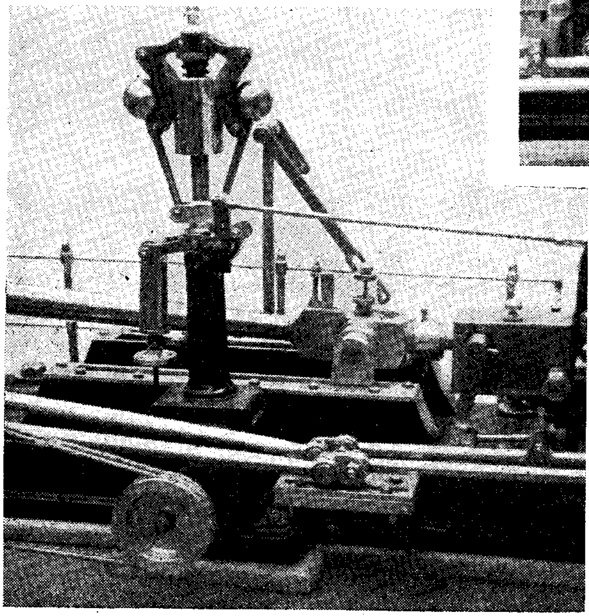
(All this should be clear from a study of Photographs Nos. 2 and 3.)

Now, ignoring for a minute the control of the governor, it will be seen that when the spring clips are closed, ready to pull open the valve (rear valve, Photograph No. 2), the cam-lever is in such a position that the cams do not affect the clips. However, as the valve-rod moves inwards, opening the valve, the cam-lever becomes more erect, because its upper pin is more or less stationary, thus erecting the cams, which gradually force open the spring clips.

At a given moment in the travel of the valve-rod, therefore, the clips become disengaged from their shoulders, and the valve closes. In Photograph No. 3, the clips of the forward valve (which is open) are about to disengage, and those of the rear valve, which is closed, are sliding over their shoulders ready to re-engage—the wrist-plate is turning clockwise, of course. In Photograph No. 2, the rear valve is about to be opened, while the clips of the forward valve are due to slide forward to re-engage their shoulders; the wrist-plate is about to turn anti-clockwise.



Photograph No. 3. Another view of the valve-gear, with the foremost inlet valve about to trip and close. Note the typical Corliss type main stop valve. (*Photo by the author*)

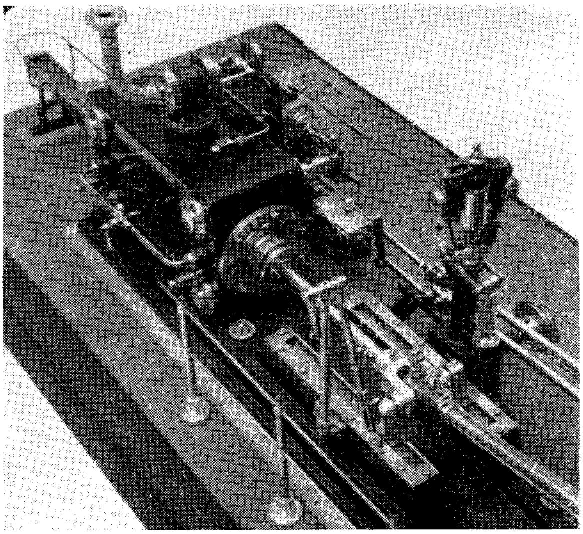


Photograph No. 4. This view of the governor also shows other details as mentioned in the text. Note also the indicator-gear, behind the governor. (*Photo by the author*)

Closure of the valves is effected by springs contained in two dashpots, mounted back to back near the top of the cylinder. The springs ensure rapid closure of the valves, thus virtually eliminating wire-drawing of the steam, and the cushions of air trapped under the pistons of the dashpots prevent jar and noise.

Governing

As seen in Photographs No. 2 and 3, the governor-rod is directly connected to the upper arm of a double-ended crank, the lower end of which is



Photograph No. 5. In the foreground, indicator-gear, cross-head, slide-bars, and governor: behind, the mechanical lubricator, cylinder-block, and tail slide (*Photo by the author*)

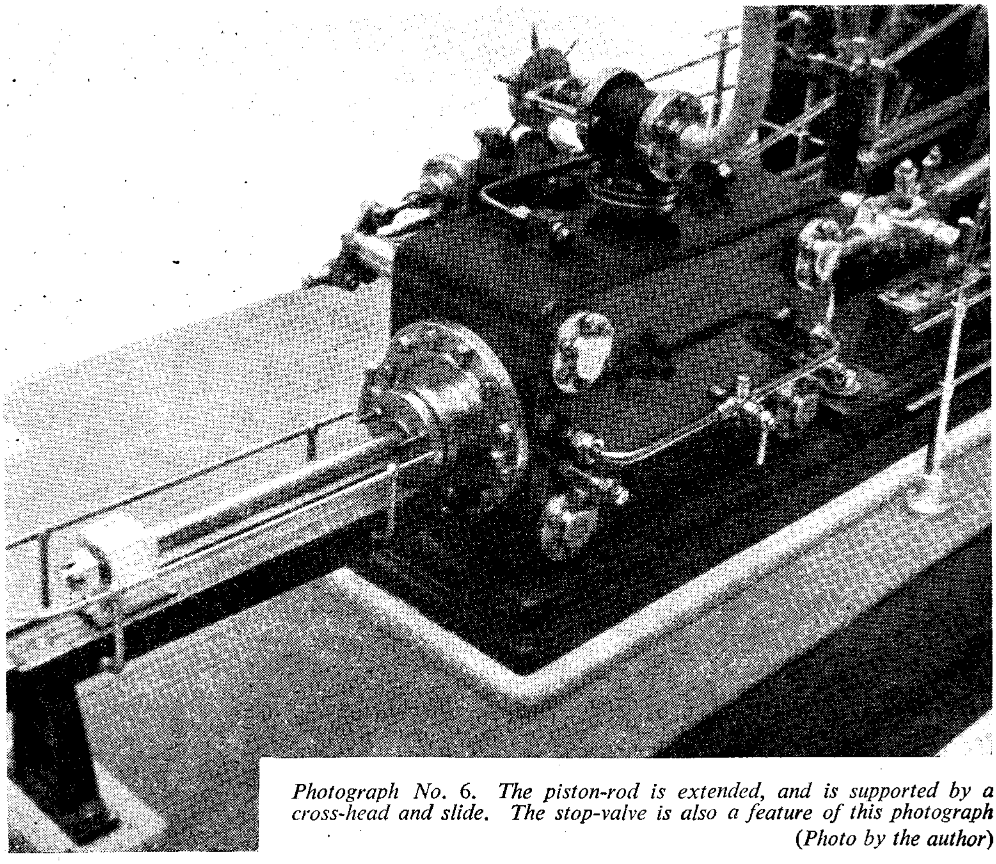
connected to the upper end of one of the cam-levers. A toothed segment on the crank engages with a similar, but single-ended, crank, connected to the other cam-lever.

Thus, as the governor-balls fly out, the cam-levers are forced apart, and the cams open the spring-clips earlier in the stroke, so that the cut-off is earlier, and the speed of the engine does not increase.

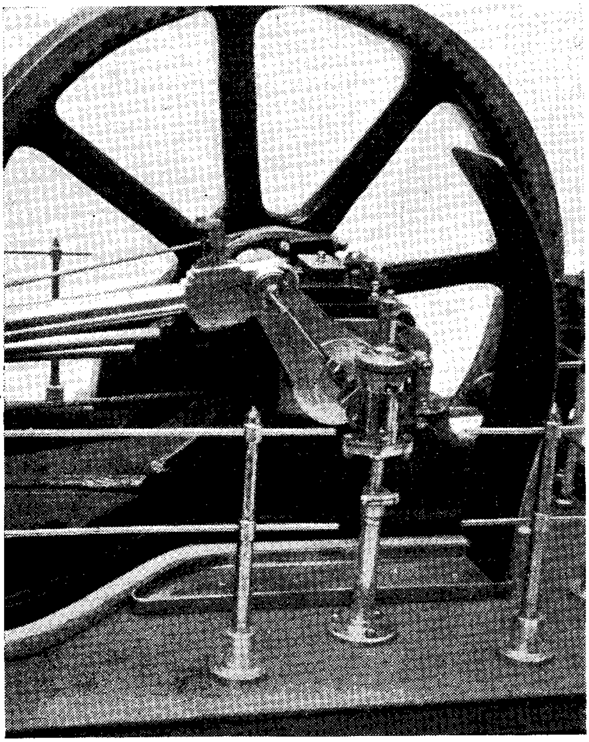
The governor (Photograph No. 4) is mounted on a stand bolted to the bed-plate, and is itself controlled by a dashpot, to prevent hunting. Also seen in this photograph are the massive cross-head and slide bars, the little-end of the connecting-rod, which is correctly cottered and possesses a beautiful little lubricator, and the two eccentric-rods with their small cross-heads. Note, too, the mechanical lubricator, driven from the exhaust-rod.

General Information

Having described the valve-gear at more length than intended, I do not propose to give a detailed account of



Photograph No. 6. The piston-rod is extended, and is supported by a cross-head and slide. The stop-valve is also a feature of this photograph (*Photo by the author*)



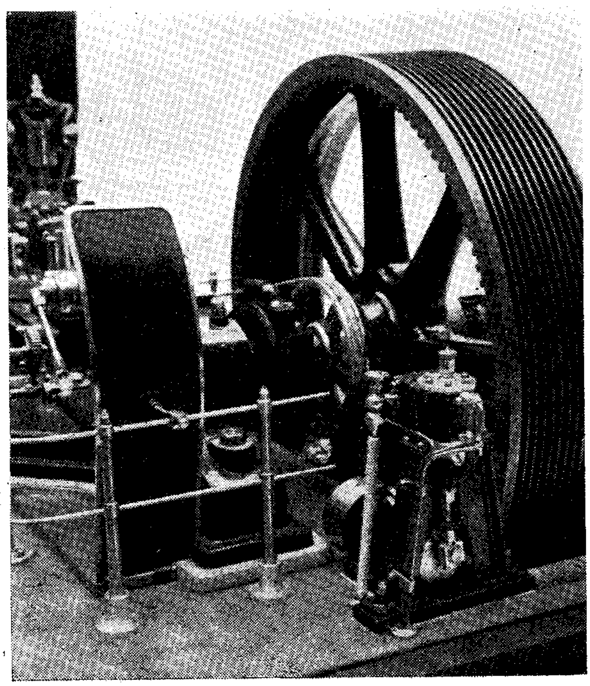
Photograph No. 7. The correctly cottered and gibbed big-end is lubricated by a Berry-type automatic lubricator. Note massive crank and bearings
(Photo by the author)

Photograph No. 8. The beautiful little barring-engine, a work of art in itself, disengages automatically as the main engine picks up speed. Note that the barring-engine can itself be barred round by means of the square holes in flywheel rim !
(Photo by the author)

the model itself; in any case the photographs speak for themselves, I think, and the captions supply quite a bit of information.

However, as regards dimensions, the baseboard is $28\frac{1}{4}$ in. by 11 in., and the rope fly-pulley is $8\frac{5}{8}$ in. diameter by $1\frac{3}{4}$ in. face. The stroke is 3 in., and the connecting-rod $7\frac{1}{2}$ in. between centres. The model is to 1 in. scale, and thus does not represent a really large engine, as Corliss engines go. But that it is a very accurate and lovely model of a prototype which is fast disappearing, no one can deny; and in building it, Mr. Barber has demonstrated once again that craftsmanship which should be the aim of every model engineer—and for which, incidentally, the name of Amos Barber is well-known throughout the north.

(EDITORIAL NOTE.—We are pleased to have had the opportunity of publishing this description of so fine a model. The beautiful workmanship displayed is, we know, not usual; but, at least, it sets a target at which we can all aim and, in due time and with the requisite care, most of us should score a "bull.")



STARTING INTERNAL COMBUSTION ENGINES

Some early systems discussed in detail

by B.C.J.

IT has frequently been a source of considerable wonder to me as to whether the first designers of the non-compression gas engine set to work to design a practical working machine in the first case—or whether, in their wisdom, they thought out a means of starting it when made!

years the custom, when assisting an obstinate horse-drawn conveyance to get going, to *haul on the spokes of the wheels*? Perhaps that was the way to bring a stationary gas engine from a state of rest to one of explosive and useful activity? Yes, indeed, and it is a way that is not altogether out of fashion even in these times.

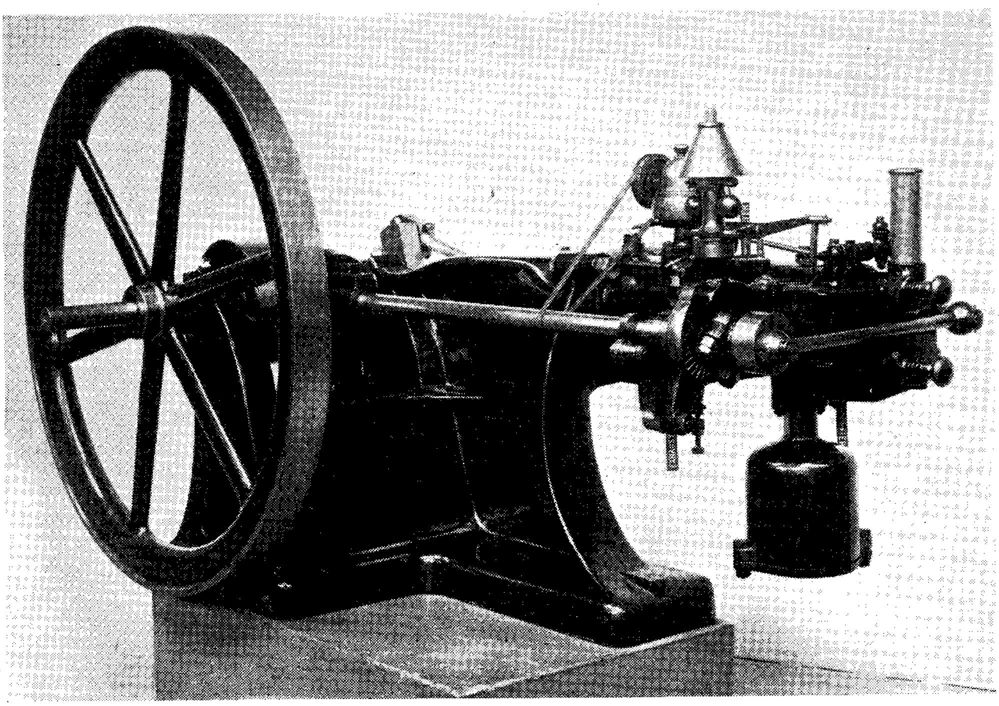


Fig. 1. Small Crossley Gas Engine. Note overhung crank and belt-pulley between bearings. The flywheel is particularly accessible for starting. (Crown Copyright. From an exhibit in the Science Museum, South Kensington)

It is to be supposed that to men accustomed to the use of the steam engine and its simple and direct starting method, a suitable means of putting the gas engine in motion would not perhaps have been too obvious. Still, obstinate steam engines may well have been pulled round by hand a few times to get them going, so that it may be that I am suggesting too much lack of knowledge in regard to the process of persuading the gas engine to get moving—after all, the gas engine would not have been much use unless it could be got moving; indeed, it would not have been an engine at all! Is it a case of the hen and the egg? Which came first. Or isn't it?

Then again, has it not been for very many

It is a way that is unlikely to be superseded in the case of any engine of but small dimensions.

In considering the old-time *non-compression* engine there really was not very formidable resistance to overcome to get the first few revolutions. The inertia of the flywheel, piston and other parts, sticktion due to lubricated surfaces, a little resistance due to the necessity for drawing in the charge of gas and air and that was about all! And the flywheel, by the way, was usually of very large diameter which would provide its own share of assistance by giving excellent leverage for the man at the wheel. The Lenoir, the Hugon, the Bisschopp—all these machines could, I imagine, have been quite easily started

by the average schoolboy! The Bisschopp in particular, due to its vertical cylinder with its freedom from friction and its generally small dimensions.

In some cases there may perhaps have been a little uncertainty in the mixture proportion and I suspect that ignition—particularly that of

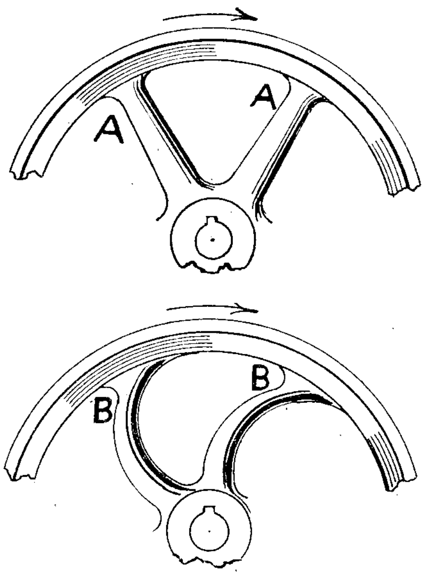


Fig. 2. Comparative sketches of straight and curved spoke flywheels, showing the superior hand-grip provided by the latter at " B."

the electrical order—may have given trouble. But, by and large, starting would appear to have been a simple and certain matter in the bygone days of the non-compression engine.

Hand-starting

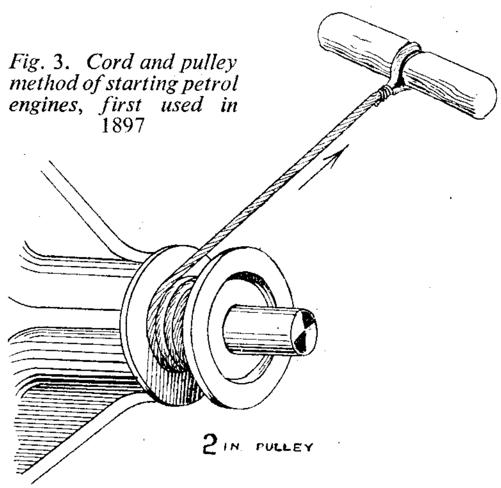
Hand-starting was adopted in all the early gas engines—whether using compression or not. In the case of the compression engine it was usual to employ some form of device—an additional cam mechanism—to give half-compression only. And even with the use of this device I have seen no less than *three* men pulling on the flywheel of an engine to put life into it!

Fig. 1 is from a photograph of an early Crossley gas engine—the flywheel being a rather prominent feature. This engine introduces an unusual starting problem. It will be observed that it is provided with an *overhung* crank, so that only one end of the crankshaft is available for a flywheel—and hence the possibility of getting the engine going. And moreover a belt pulley could not be applied to the shaft end, the belt would have rendered the spokes of the wheel inaccessible for hand hauling purposes and any attempt at starting would have been not a little dangerous. Another position had to be found for the driving pulley. It was situated betwixt and between the two main crankshaft bearings—which would certainly not assist the application of a driving belt, and it would also restrict the diameter of the pulley. But I do not think that these seeming objections interfered with the sale of the engines in very considerable numbers. So all was well. Crossley Bros. must have built a great number of these serviceable little engines. I can call to mind only *two* other cases of *overhung* crank application to a gas engine—though the steam engine makers made much use of this constructional feature. The two cases are the " Ideal " gas engine of bygone days and a small engine recently described in these columns.

Now we have to consider the question of curved *versus* straight-spoked flywheels. The gas engine maker seems from the earliest days to have taken kindly to the curved spoke. Why? Because it suited the heavy flywheel rim and it offered a much more convenient and comfortable hand grip than the straight-spoked article. I think Fig. 2 makes this only too obvious. At *A* the hand tends to slip out of position whereas at *B* there is a comfortably curved hollow surface in which the hand can lodge. I put this matter to the test in my own workshop using a rather small (2 ft.) wheel for the curved spoke test and an even smaller wheel for testing the straight spoke. Still the test was rather convincingly in favour of the curved spoke.

The gas engine maker, I think, practically always arranged his wheel—or wheels—so that the most convenient hand-grip provided by the spokes was available for the one or more men

Fig. 3. Cord and pulley method of starting petrol engines, first used in 1897



urging an engine to give its first impulse. How many times in the past have I watched the efforts of a man in charge of an engine directing his energy to one thing only—to persuade an obstinate gas engine to do a job of work! And how seldom has this been *unaccomplished.*

I can, however, recall a case in which a very small compression engine, my own property, took, in the first case, *two days* to start. Indeed, I had it in my possession for two days before the trick of starting it occured to me. My usual procedure was—I was very young at the time—to grasp the rim of the flywheel and administer a quick jerk to it. The result—an unfailing rebound on the compression stroke! And no

start! Readers will know that the correct *modus operandi* was to coax the engine gently round past the suction stroke until the commencement of the compression stroke—and *then* give a sharp pull on the flywheel rim. Then she would go! Well, we live and learn!

Starting by Cord and Pulley

In the year 1897 I was engaged in the business of a well-known consultant of the period—Frederick R. Simms. Almost my first piece of work was to design a small horizontal petrol engine—I think it had a bore and stroke of 65 × 65 mm. This engine was built at the long ago demolished works of Bryan Donkin, at Bermondsey. I must say something later about the surroundings of these works, but in the meantime I would inform the expectant reader that the aforesaid engine was on one occasion made secure to a foundation and was deemed ready for trial. But there was no trial and for a sufficient reason—the engine could not be started. The ignition system was the now somewhat out-of-date low-tension magneto ignition of Bosch. There could be no spark if the oscillating envelope were not oscillated with suitable angular velocity. See Fig. 4 for sketch of magneto machine; Fig. 5 is a sketch of the sparking-plug. This matter, of course, depended upon the rate at which the engine crankshaft could be turned. And neither my assistant—Mr. Hankinson—nor myself could provide sufficient speed—not even under the influence of Bermondsey air and after a good lunch! I therefore set to work all the grey matter I possessed and ultimately gave birth to the cord and pulley method. (See Fig. 3.) This merely consisted of a small flat-faced flanged pulley mounted on the engine crankshaft, around which a foot or two of stout cord was wound. The sketch in Fig. 3 shows this device pretty clearly. A long pull and a strong pull on the cord rotated the pulley, revolved the crankshaft, oscillated the envelope of the magneto machine, tripped the small lever on the ignition plug (Fig. 5), produced a good spark and at once got the engine going at a satisfactory speed. In one form or another, this device is in common use today, principally among speed-boat enthusiasts. I wonder if any of them ever heard tell of these early experiments carried out at Bermondsey—with its invigorating air? I wonder! And this brings me back once more to the salubrious surroundings of the Donkin works.

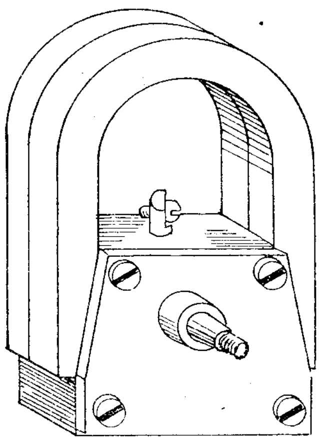


Fig. 4. Sketch of early low-tension magneto machine with oscillating envelope between pole-shoes and armature

One could always be sure from which direction the wind was blowing by the all-pervading aroma. A weather-cock was not at all necessary. In a northerly direction was a tannery—indeed I think there were two. On the west side was a glue factory. Other points of the compass indicated jam and pickles—and the jam varied according to the season. Yes, the odours of Bermondsey were very informative—and sometimes offensive—but maybe appetising on occasion! I think most of us became acclimatised to these odours so to speak in due time.

I cannot refrain from referring to another interesting feature of the long dead and demolished works of Bryan Donkin. *There was a beautiful old beam engine to provide the essential power.* Often did I gaze upon this fine engine and in this manner I must have wasted no small amount of the firm's time! I do not know who its builder may have been or in what year it was built. But I *do* know how and when it met its doom and its destruction. It was broken up for scrap iron. Men came with heavy weights which they suspended and caused to fall from a few feet upon the cylinder and other cast-iron parts. Crash! And there was the cylinder in several pieces on the floor of the engine room. Then other hooligans came along with sledge hammers and completed the destruction. A sorry sight! Yes, a sorry sight indeed! Never did any little crowd of onlookers witness the axe fall at an execution with more sorrow and grief. Never did any little batch of budding engineers have better cause for bitter grief. As for myself I went home and wept—I think I must have done! In order to conclude this paragraph in a more cheerful tone, there is another little matter which perhaps I may be excused for placing on record here. The first successful run of this little air-cooled petrol engine was celebrated by the opening of a bottle of champagne—shared by the two or three fortunate persons present. I was, of course, one of them and I think I still have the cork in my possession, which I retained as a memento of the occasion—or has it disappeared—floating away, perchance, on the tides of time? I am not sure. I have many other

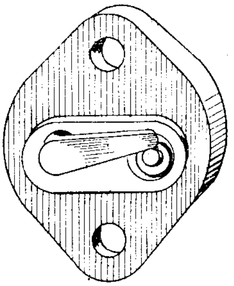


Fig. 5. Low tension ignition plug, showing details of internal contacting parts

recollections of Bermondsey, in spite of its smells—of pub. lunches prepared by a retired sea-going cook, of most savoury blackcurrant tarts, of the making of two life-long friends! But I am drifting away from my subject.

The Lanchester Starter

Quite a number of forms of starter were introduced about this period. Gas engines were getting larger. Manual starting was altogether too much for one or even two men. The Lanchester starter was at one time very popular—as, indeed, was its inventor. For a description of this device I must perforce rely upon memory. Ancient text-books do not appear even to refer to it. Presumably because it has long passed out of use.

Mounted on the upper part of the combustion chamber was a fairly large plug cock, across the upper end of this a gas jet was provided. (See Fig. 6.) Means were also provided for admitting coal gas into the lower part of the combustion chamber, and this gas, mixed with air, found an exit through the plug cock, where it was ignited by the horizontal gas jet. Presently the flame caused by the issuing gas and air commenced to " roar " and this clearly indicated that the mixture contained in the combustion chamber was of explosive proportions. Immediately the gas entry cock would be closed and the external flame would spread back into the combustion chamber causing a pressure rise sufficient to give a preliminary impulse to the engine. I should have remarked that at the commencement of operations the crank was placed in such a position that there was about two-thirds of a stroke of the piston left to complete a revolution. And I think there must surely have been a valve embodied in the cock to prevent escape of the pressure.

It may be that my description of this device is by no means an accurate one and perhaps some kind reader will say where I am in error. (I do not think I can have given the matter a thought for something like 40 years!) Somewhere, doubtless, there is tucked away in some technical library a text-book containing a description and illustration of the Lanchester device. And where could one delve to better advantage than at the Patent Office? But this source of information is far out of my reach now Time was when I would search diligently amongst its many thousands of volumes for some particle of much wanted information! But not now!

A form of starting gear used in some early Otto engines made use of a strong metal container which was charged by means of the exploding gases in the cylinder. There was a spring loaded valve which hindered live gas under compression from entering the starting chamber. This seems to have been essential otherwise there would be a possibility of a very high pressure explosion taking place. The compressed gas was made use of for starting, very much in similar manner to that commonly adopted in modern diesel engines—there would be a cam-driven mechanism to deliver the compressed gas at the correct period. This kind of starting system has been backed up in modern engineering by a belt-driven air compressor or some such device.

Dugald Clerk, of gas engine fame and of many inventions designed a somewhat similar arrangement for starting. Further description is, however, unnecessary.

Starting up the old-time gas engine presented in truth interesting problems, but none, I think, of so much fascination as exhibited by the human effort devoted to this purpose. To witness a couple of muscular engine room attendants applying their energy to the spokes of a flywheel, or perhaps two flywheels, for may be a minute or more and then suddenly to realise that the engine had taken over the work—by

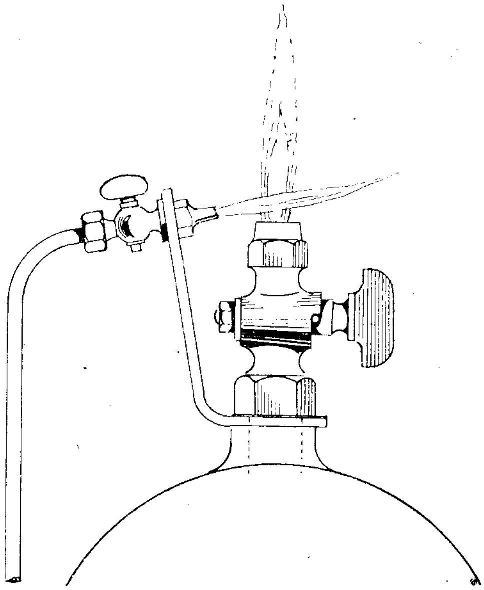


Fig. 6. *Sketch (from memory) of Lanchester starter*

noting the spasmodic impulses imparted to the flywheels and somewhere not far afield the harsh bark of the exhaust and the rapid speeding up of the whole engine, until the governor, ever on the alert, began to play its part by putting a check to the r.p.m. and thus preventing the machine " running away "'—and possibly bursting a flywheel or damaging delicate machines, which were intended for a comparatively slow speed—and all this the result of a satisfactory and safe manual start, without which no gas engine has any practical value—and all the result of a well-built and well-designed engine and finally the result of the brains of generations of experienced and well-informed gas engine experts.

On turning back the pages of this article which have already been written, I observe that I have not had a great deal to say about the modern engine and modern methods. Well, I do not think I shall make any attempt to correct this omission, for I think I can affirm that the average reader of THE MODEL ENGINEER enjoys being carried back in leisurely manner to the past—even more than he likes to be pushed and hurled forward into the future! I wonder if readers will confirm this opinion!

"CLIMBING THE GLASS MOUNTAIN"

The Saga of a Remarkable War-time Enterprise

by R. Razoux Kühr (Amsterdam)

AS an avid reader and subscriber to THE MODEL ENGINEER, I have noted on several occasions the high praise given by different people to the journal, and it has been my wish for some time to add to this. However, when it comes to writing down one's own experiences, I find that one becomes rather hesitant. Still, I believe the following will not be entirely devoid of interest.

THE MODEL ENGINEER has done a lot of things for quite a number of people, and all have benefited by it, no doubt. This story will go a shade further, and show that it was instrumental in saving at least one life during the last war, while at the same time others have profited by the practical information gathered from its pages.

Not long after the island of Java had capitulated to the Japanese, the writer was taken ill, and spent nearly two years in a P.O.W. camp hospital, in which period it became clear that apart from physical suffering, many inmates would have been happier if they could read. Due to malnutrition, failing eyesight was a common complaint, while others had lost their spectacles during some " manual instruction " at one time or another by the wardens.

The idea ripened to grind lenses. The writer remembered a series of articles which appeared in 1918 or 1919 in THE MODEL ENGINEER, describing the hand grinding of a telescope mirror. Time was immaterial, and lenses could be hand-ground, that was the main thing.

Before actual steps to this end could be taken, the writer was transferred to a camp called the 10th battalion, and oh, wonders ! Here they had a workshop. And in that workshop a lathe. The lathe was camp-made, using an Austin motor cylinderblock, for the headstock and the crankshaft as mandrel. This was bolted down to a bed of steel rail. It was equipped for screw-cutting, too ; gearboxes of different cars supplied the gears. The rack was hand-filed, tooth by tooth, but I do not recall how the leadscrew was machined. This machine was a marvel of design and patience, apart from the circumstances under which it was built.

Not two days in this camp and the writer was on parade for a draft to Burma. You will have heard of the Burma Railroad that cost a P.O.W.'s life for every sleeper laid. With the co-operation of the eye-specialist and the camp-commandant, replacement for the draft was found and details of a small lens-grinding machine were worked out and taken in hand. The builder of the lathe, a South African by the name of Onink, took care of the machining. Between us we cooked up a grinder any amateur would have been proud to own, and a splendid machining job was made of it, too.

The bearing plates were made up from the body of an old centrifugal pump, spaced by distance bolts. The spindle was part of a steel car axle. This ran in a bronze bearing on a steel ball in the bottom plate, while a taper bearing in the upper plate took care of end adjustment.

A wooden pulley was clamped on the spindle between the plates, and a well-made spilling pan stood on top, the spindle end coming through a central hole with collar.

The grinding cups were cut from a machine-room footplate, hammered to approximate curvature, with the diamond design on the inside. To the other side was welded a gas-pipe sleeve to fit over the spindle, with a slit for the driving pin. The curvature was turned on the lathe to an average curve for glass of 1.5 refractive index and a certain lens.

Yes, we were able to weld electrically. The welding-rods were straightened barbed wire, with a protective coating of whitewash. This worked quite well, current being supplied by a rotary converter giving about 80 A, and 100 V.

The first grinding cup having been prepared, a nice bit of glass was picked from a pile of broken car wind-screens. A Ford windscreen I believe it was. The sheets of which this was built up were taken apart and a round cut out. This was fixed with sealing wax to a car-motor valve for a handle.

Grinding powder was obtained by crushing bits of broken carborundum grindstones ; the finer grades by washing during the grinding operations. As a polishing medium, use was made of rust carefully scraped from some iron bars that had been out in rain and weather for months. Later we were able to use proper rouge.

When the first lens was ready, careful measurement was made of the focal distance by the aid of the sun. Simple calculation then showed what the correct refractive index was for the glass used and the curve of the grinding cup adjusted accordingly. A range of cups was then made, enabling lenses to be ground of plus to minus 10 or 12 diopters with $\frac{1}{2}$ diopter increments.

Again there was a draft, and again the writer was taken off it in the nick of time. (This draft, some 1,800 strong, was torpedoed off the West coast of Sumatra. There were about 40 survivors, of which hardly a dozen are alive today).

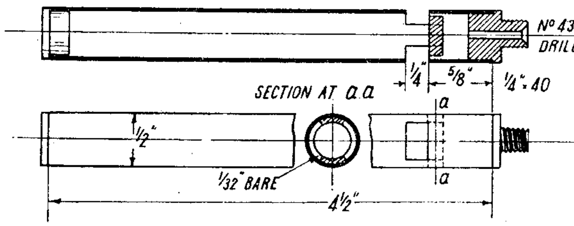
The frames of the spectacles were made from aluminium sheet. When a man was allotted a pair by the eye-specialist, a rim about 1 in. wide was cut from his aluminium mess can. There was never enough food, so if we had cut up to 1 in. from the bottom, it would not have mattered anyway !

(*Continued on page* 81)

"L.B.S.C.'s" Beginners' Corner

Blobs and Gadgets

AMONG correspondents' letters, I often find one from a beginner who seeks some information or advice relating to fittings and mountings; the things I usually lump together under the heading of "blobs and gadgets." Sometimes the query relates to something very simple, and sometimes it is rather complex; but the querist very often apologises in advance for his "ignorance," and hopes he isn't wasting my time. Now first of all, let me assure all and sundry, that no apologies are needed from any genuine seeker after information; the only point is, that he should make absolutely certain that the answer to his query cannot be found by a little thought or simple deduction, and also that it is something I have not dealt with quite recently. For example, after all I have explained about the absence of natural draught in small locomotives—and big ones, too—it *is* wasting both my time and the querist's, when he writes to ask why the fire goes out when he shuts the blower valve! That happened a fortnight ago, at time of writing. Anyway, I thought that some subjects mentioned in recent letters from beginners, novices, and tyros (all ages from 14 to 65!!) might well form the basis of a little general dissertation; so here goes.



Double-slotted whistle

Air v. Steam

I expect most folk know the story of the schoolboy who made a wooden whistle, but it wooden whistle, so he tried a steel whistle, but steel it wooden whistle; then he made a lead whistle, but steel it wooden let him whistle, so in despair he bought a tin whistle, and now he tin whistle. Well, a young beginner made a nobby whistle from a piece of brass tube, and it gave a clear note when he blew it with his breath, or by air from a tyre pump; but when he put it on his engine and turned steam into it, it only gave either a "bobble," or an unearthly screech. He wants to know why; and if all queries were as easily answered, I shouldn't worry! The "bobble" was caused by hot steam condensing in a cold whistle and leaving water in the tube, which couldn't get out as steam was blowing across the aperture or sound opening. The screech was caused either by steam rushing too quickly across the opening, or the opening itself being of unsuitable size and shape, or a combination of both. I gave some information on this subject in the *Live Steam Book*, but here are a few additional "'ints and tipses" which might prove useful.

"Bobbling" can be entirely eliminated if the whistle can be mounted in some place where it keeps hot. On my *Tugboat Annie*, it is clipped to the underside of the ashpan. On *Tishy* and *Ayesha*, the whistles are right close to the bottom of the boiler backhead, and lie crosswise. These whistles blow a clear note at all times, as they keep hot enough to prevent condensation of the steam. Where the only place available is under the running-board, the whistle should be placed as far back as possible, to keep it out of the rush of air when the engine is running. In all cases, the steam should be as dry as possible; if superheated steam can be used, so much the better. The full-size *Britannia's* whistles are on the side of the smokebox, and take steam direct from the header inside; and if all goes well, the hidden whistle on the small one will have hot steam too, so as to get a clear note, or rather notes, as it will be a chime whistle.

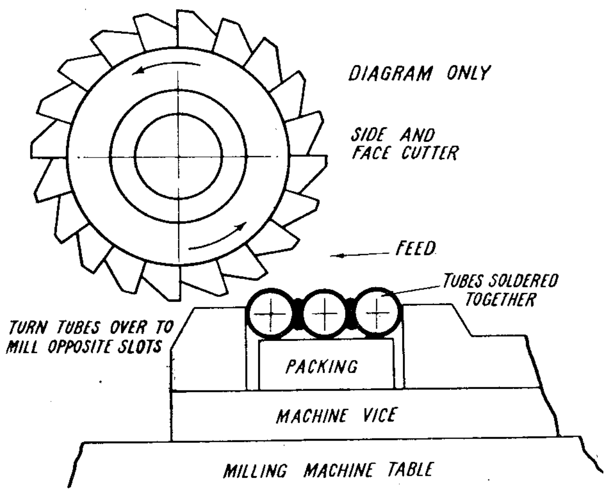
To avoid screeching or blasting, either the supply of steam must be cut down to the right amount for a clear note, or the steam slot must be enlarged to suit the boiler pressure. The organ-pipe type of whistle which I often specify, with an arch-shaped sound opening, works very well with a slot about 1/64 in. wide, supplied by steam through a $\frac{1}{8}$-in. pipe; but it will screech at high pressure if the pipe is thin-walled and lets a good flow of steam through it. If the width of the slot is increased to 1/32 in., the whistle will blow a clear note with the bigger pipe, but it will be louder. Alternatively, a $\frac{1}{16}$-in. hole through the union screw, to wiredraw the steam a little, would stop the screeching. The length of pipe is an important factor, too; the longer the pipe, the bigger will be the hole needed through the union screw.

Bell and Double-slotted Whistles

A "bell" whistle—that is, one with an annular steam slot, and a whistle tube entirely separated from it, gives a beautifully clear note free from "bobbling"; but there is the usual wasp in the jampot. In this case, it is the difficulty of maintaining the "bell" tube dead in line with the slot. Even with a whistle tube $\frac{1}{2}$ in. diameter, and a $\frac{1}{4}$ in. central rod, the alignment doesn't last the

proverbial five minutes. I made a real peach for *Jeanie Deans*, which hit off Francis Webb's signature tune to a tee, but after I accidentally pushed the bell slightly out of plumb when lifting her (the whistle is under the trailing end, and she's heavy !) it sounded like the wail of a banshee, or the ghost of F.W.W. calling to his engine, so I replaced it by a slotted one, which isn't so reminiscent of Victorian Crewe, but keeps musical.

The best alternative to the bell whistle is the double-slotted type. A good many years ago a correspondent told me that he had trouble in getting a whistle to blow a clear note under pressure ; and his daughter, a L.M.S. railway-woman, said " Try another slot the other side, dad." He did, and the problem was solved. Incidentally, the young lady in question astonished the enginemen at Rugby sheds with her knowledge of locomotive matters, and could discuss valve gears and other intricate subjects with the best of them. If any old Rugby engineman reads these notes, he may remember Miss Ingrey. Well, that was a case of great minds thinking alike, for some of the old look-out men's whistles were of the double-slotted type, and they are also used as factory hooters, apart from locomotive and marine use. Single-note air whistles, used on electric stock, are usually double-slotted.



Multiple slot milling

They are rather more tricky to make than those with a single slot ; but I recently wangled out a simple way of making them by mass-production methods, and this is how it was done.

Three Birds with One Shot

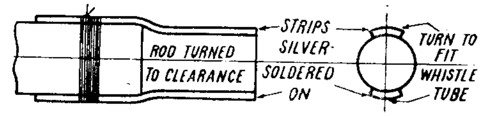
It came to pass that I needed three whistles at once, one for my own use, and two to give to friends " for services rendered." As it happened, I had run clean out of $\frac{1}{2}$-in. thin brass tube, but friend Reeves soon put that right, having some of the right kind in stock. It was only a few minutes' work to saw off three lengths and square the ends in the lathe to a dead length of $4\frac{1}{2}$ in., but it would have taken a wee bit longer to have marked out and filed three double slots by hand, so I thought I'd mill them, doing all three at once. Up popped the merry old wopsy from the jampot again ; how to hold the three thin tubes in the machine-vice on the milling machine table rigid enough to stand the cut ; how to ensure that the slots on each side were exactly opposite and the same depth, without a lot of measuring. Well, if there's an easy way out, you can bet your last dollar, if you have one, that Curly won't be long in finding it (getting lazy in my old age, I guess) so I laid the bits of tube on a piece of thick asbestos millboard which happened to be flat. The ends were lined up by holding a steel rule against them ; they were lightly held together with a toolmaker's cramp, and soldered at both ends, thus making a solid block.

I happened to have a length of round wood that just fitted the bores, so I cut three bits off it, and pushed them through. The whole issue was then laid on a packing block in the milling-machine vice, one end of the tubes level with one end of the vice jaws, which were tightened up. A $\frac{1}{4}$-in. side-and-face cutter was put on the arbor ; the table adjusted to cut the slots at the right place and at the right depth, the machine was started, and in two wags of a dog's tail, the three slots were cut. To do the opposite side, all that was needed was to slacken the vice, turn the whole shebang over, setting it with the ends of the tubes level with the end of the vice jaws as before, tighten up, and take the other cut. Lining up the tube ends with the vice-jaw end, ensured that the slots were cut at the same distance from the ends, on both sides of the tube ; resting the soldered-together tubes on a flat bit of packing, ensured that the slots were not only exactly the same depth, but exactly opposite. Judicious application of a small gas flame from a home-made self-blowing blowpipe (the one I use for boiler fittings that require silver-soldering) melted the tubes apart, and it was only a couple of minutes' work to wipe off all the solder.

Built-up Discs

Each whistle required a disc with two segments cut out of it, the same length as the slots in the tubes ; these, of course, are fitted at the bottom edge of the slot, to blow steam across the opening. They were made in the same easy (? lazy) fashion. A piece of $\frac{7}{16}$ in. round brass rod was chucked in the three-jaw, and turned down for about $\frac{3}{4}$ in. length to a diameter approximately 3/64 in. less than the bore of the whistle tubes. A strip of 16-gauge sheet brass, $\frac{1}{4}$ in. wide, was placed at either side of the turned-down part, slightly bent to suit the full diameter of the brass rod, and tied in place with a bit of iron binding wire. These strips were silver-soldered to the end of the rod where it was turned down, using the silver-solder on the Cohen-McPherson principle. After quenching in pickle and washing off, the binding wire was removed and the rod chucked

in three-jaw with the strip end outwards. The outsides of the strips were then skimmed down until they fitted tightly into the whistle-tubes; after which, three $\frac{1}{8}$-in. slices were parted off—and there were the discs, with rounded segments exactly parallel with the whistle tubes. All that remained was to push them in until the segments



How to make discs

lined up with the slots and were parallel with the edges; a bead of solder no bigger than a pinhead, a spot of Baker's fluid, and a slight application of the little blowlamp flame, fixed them in place.

The rest of the job was the same as described for other whistles; a plug was fitted to the upper end and a combined plug and union screw to the lower end, as shown in the illustration, which needs no explaining. All three whistles blew a clear note at 80 lb. boiler pressure. If any beginner wants to make a similar single whistle, he could file the slots; but if he wants to make three, the soldered-up block of tubes could be held in a machine-vice (regular or improvised) on the lathe saddle, and the cutter mounted on an arbor between centres.

Injector Fitting

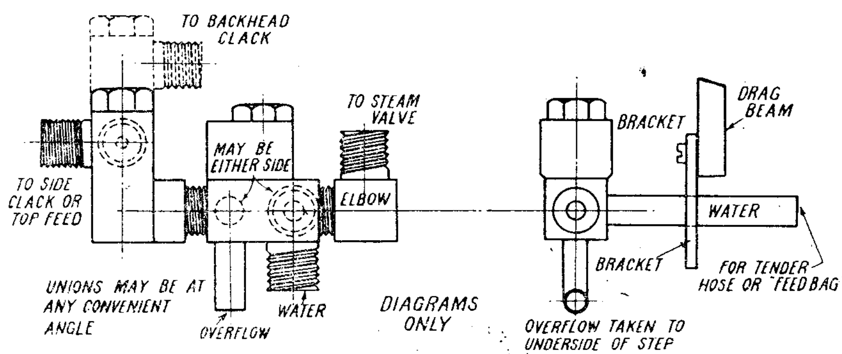
Several new readers have asked for information on fitting injectors on certain types of engines, saying that while I have given instructions on how to make the injectors and fit them to specific engines, I haven't said much about their general application. Quite true; so, in the interest of readers in general, and beginners in particular,

said about fitting them in accessible positions, according to the type of engine.

On a 2-8-2, 4-6-2, or any similar type with a radial trailing axle or pony truck, plus a wide firebox, the best place is at the side of the firebox, low down, between the trailing coupled axle and the pony or radial axle. My *Tugboat Annie* has her injector in that position, and it has also been adopted on the *Britannias*. It not only affords the maximum accessibility, as all three union nuts are in full view and can be disconnected in a matter of seconds, but there is a direct pipe run for the water from tender to injector, and from the latter to the top feed or side clack, and only a short run from the steam valve on the backhead to the steam cone. If the engine has no side clacks, nor a top feed, but a clack on the backhead for the injector delivery, an excellent location is to put the injector transversely just below and slightly ahead of the drag beam. Again, the nuts are easily get-at-able; and in this position only two nuts are needed as the water pipe, being very short, can be silver-soldered direct into the side of the injector body and the water union dispensed with altogether.

This location can also be used on a 4-6-0 or 4-4-0, or similar type, in all cases where the feed is taken to a clack on the backhead; but if the engine has side clacks or top feed, then the best place for the injector is under the left-hand step, setting it so that the unions are clear of the step.

As to the tank engines, the location will depend on the type of engine. On a pannier or saddle tank, the most accessible position is just below the bottom of one of the tanks, same as I specified for a G.W.R. 1500 class engine described in a contemporary journal some time ago; and on side tanks it will also depend on the wheel arrangement. A very convenient location was that given for the revised edition of *Juliet* recently illustrated. This position can be used



Alternative injector connections

let's do a little to remedy the deficiency. As a matter of fact, the little gadgets having merely to be attached to three bits of pipe, for steam, water, and delivery, they can be located almost anywhere as far as working is concerned; but they require cleaning occasionally, where the water is not of the purest, so a little might be

either with side clacks, top feed, or backhead clack, the feedwater pipe being short and direct, and the delivery pipe can be arranged without sharp bends. On my 4-4-2 tank engine *Olga*, the original position of the injector was under the footplate, arranged transversely. This was very convenient for pipe work, the steam and delivery

pipes being short and direct, and the overflow pipe was extended to the underside of the left-hand step, in full view from the driver's position on the car behind the engine ; but it wasn't so handy for cleaning, and after stripping the thread in the nut of the steam union, I shifted the injector to a position outside the frame, behind the footstep. This lengthened the pipes, but rendered the injector accessible ; also, it enabled other injectors to be tested on that particular engine, as they could be changed in a minute or so.

Permissible Alterations

Some types of full-size injectors are arranged so that they can be used both right- and left-handed, and the steam, water, and delivery connections varied to suit different types of locomotives and different locations. Same principles can be applied to little injectors, provided that the cones are made and fitted as per specification. For example, an elbow carrying a union screw at the side, top, or bottom, can be used at the steam cone end, instead of a direct straight pipe. This obviates the use of a steam pipe with a sharp bend in it, which might kink, and obstruct the steam flow. It doesn't matter a Continental whether the water union is underneath the injector body, or at either side of it, as long as the water goes in between the steam and combining cones. Same applies to the overflow ; if you are not sure which will be the most convenient outlet, drill a hole each side of the overflow space, as well as underneath it, and tap all three. The two that you don't use, can be closed up with weeny hexagon-headed screw plugs.

The delivery clack on the end of the injector body doesn't *have* to have the union screw on top. The top may be closed by a hexagon-headed cap and the union screw silver-soldered into the side of the ball chamber, pointing in whatever direction you may find most convenient. This arrangement is especially suitable where an injector is fitted under the running-board just below the cab. The steam pipe can come straight down from the backhead steam valve, and the water delivery pipe run straight from the side union, underneath the running-board, to the point where it turns upward to meet the side clack or top feed. The clack on the end of the injector body can be placed horizontally, if that position should offer advantage in any specific case, and a very light spring fitted to keep the ball on its seating when there is no steam in the boiler. One of my engines, *Annabel*, originally had that arrangement, and it worked all right. Alternatively, the clack need not be fitted to the injector direct, but may be on the frame and connected with a pipe, like the delivery clacks on *Doris* ; but it is best to have the clack directly on the injector, as this keeps the delivery pipes full of water and helps to keep the injector itself cool.

Nothing Doing !

There is an old saying that Scotsmen can't see a joke, but a young Scotsman recently wrote that he enjoyed a hearty laugh at his own expense —a' free, ye ken ! He made an injector to words and music, and before fitting it to the boiler, thought to try how it would squirt ; so he coupled a tyre pump to the steam end, connected the water union to a tank by a rubber tube, and pumped. All he got, was a spray from the overflow. He checked measurements, found all O.K. and was just about to seek your humble servant's advice, when he suddenly remembered *that the action of an injector depends on the jet of steam condensing in the water* ; and as air naturally wouldn't condense in water, that fact accounted for the milk in the coconut ! When he tried the injector on the boiler, it worked O.K. Conversely, I knew of several cases where a tiny donkey-pump, such as I described in the *Live Steam Book*, has worked perfectly under air pressure, and refused to work under steam. The steam condensed in the long steam passages and caused water-lock. These pumps perform best when mounted on the side of the smokebox and supplied with superheated steam.

"Climbing the Glass Mountain"

(*Continued from page* 77)

I remember some people crying when they were again able to read a book. There was one British officer who lost a glass of $-6\frac{1}{2}$ diopters. He was practically blind without it. This required glass much thicker than was to be had from the rubbish pile. After some searching, a glass jar was found, of suitable thickness ; and, indeed, after parallel grinding and polishing, the piece was found to be free from blemishes, so in due time a minus $6\frac{1}{2}$ lens was fitted to the old spectacle frame. Was that man pleased ! There were Australians, Americans and Dutch, all served alike.

In the course of some ten months, about two hundred pairs of spectacles were made. A few months ago, I met a man who maintained that he preferred wearing the original pair of camp-made spectacles in the cinema.

I wonder how many of these specs. will still be about in other parts of the world ?

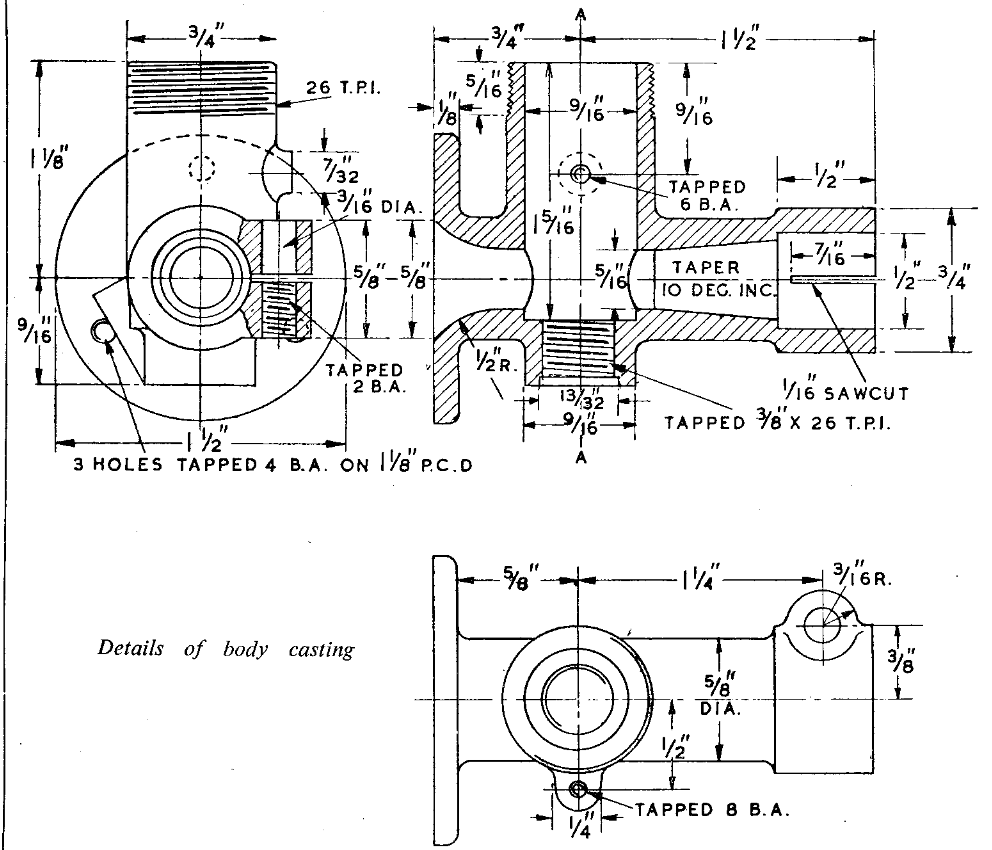
It was THE MODEL ENGINEER that started this, however, and it has given me very great pleasure indeed that I have been able to bring out, for the benefit of fellow P.O.W's, knowledge gathered from its pages. At the time of reading, I never for a moment imagined that this knowledge would come in handy in later years.

Again, thank you, THE MODEL ENGINEER, for all that you have meant to me, and the enjoyment still derived from your pages.

*A Carburettor for the "Busy Bee"

by Edgar T. Westbury

IN the construction of the carburettor, three light alloy castings are specified: namely, the body, float chamber, and air cleaner cover. These are of a simple nature, and it is hoped that they will in due course be available to readers absolutely necessary. The body was made from a four-way duralumin pipe union, obtained from the surplus market, and some of the other parts improvised from similar odds and ends. While this is quite a sound procedure in experimental



Details of body casting

through approved trade channels; but alternatively, they could be fabricated or machined from the solid without much difficulty. The remainder of the parts can be made from stock material, mostly round or hexagonal bar, and there is a good deal of latitude in the choice of metal which can be used.

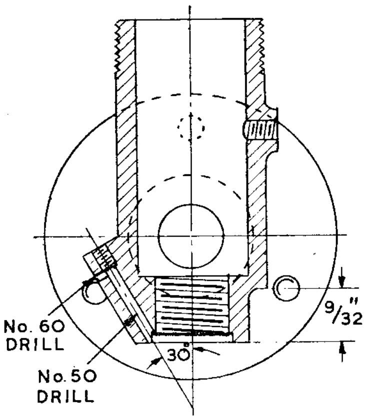
It may be mentioned that in the experimental carburettors, no castings were used, and in view of the probability that more or less extensive modifications might have to be made, no more work was done on the external form than was work, it involves a good deal more tinkering and scheming than is desirable in working to a more or less finalised design, and the finished appearance is somewhat crude. In common with my usual practice in these matters, the crude prototypes have been used as a basis for a cleaned-up design, in which neatness of form, and economy in machining and fitting, have both been given due attention.

Body

The casting for this may be held by the discharge end in the four-jaw chuck for the initial machining operation. It should be set to run

*Continued from page 9 "M.E." July 3rd, 1952

true over the neck behind the clamp lug, and also that adjacent to the intake flange, preliminary to facing the flange, turning its outward edge, and drilling through the centre. The bore should be finished $\frac{5}{16}$ in. dia., and the flare may be formed by first using a 60 deg. countersink,



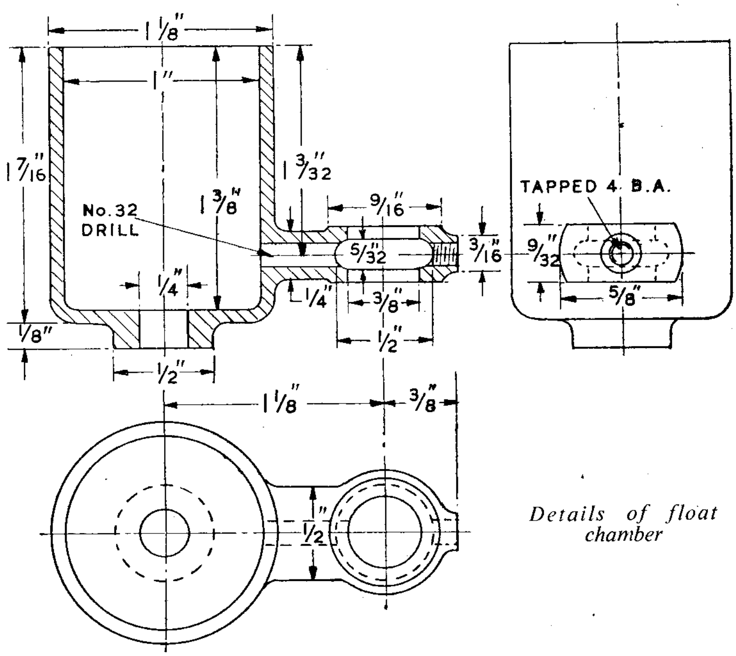
Cross section of body, showing air bleed passage

such as a large centre-drill, and then fairing out with a hand tool or half-round scraper. It is not necessary to split hairs about the exact radius of the flare, but it should give a good sweep, and blend nicely into the parallel bore, which should also be as smooth as possible.

To those who may be tempted to enlarge the bore of the passage, in the hope that it will improve the engine performance, my advice is—try it out first; it is much easier to enlarge the bore, *should it be found desirable*, than to make it smaller. The assumption that an engine will run faster if the intake area is increased does not always work out in practice; but even if it does, it is nearly always at the expense of flexibility or low-speed pulling power. There is an old story about an efficiency expert who saw a shepherd driving a large flock of sheep through a small opening in the pen, and suggested that if the opening were made twice as large, he would be able to get twice as many sheep through. "Ay, mister," was the reply, "but I ha'int got twice as many sheep!" Actually, the observer had missed the point of the narrow opening, which was to enable the sheep to be counted as they went through. Similarly, the object of restricting the throat diameter of a carburettor is often misunderstood; it is to ensure that under *all* conditions of working, the air velocity is sufficiently high to atomise and mix the fuel with the air, and if the passage is well designed, the throttling effect of the reduced bore is very much less than might be supposed.

The casting may now be reversed, and held over the intake flange in the internally-stepped jaws of the chuck, being set so that the bore runs as truly as possible, for counterboring the socket and tapering out the discharge end of the passage. It may be noted here that the clamp for securing the carburettor to the induction pipe is formed in the solid casting, instead of being made as a separate encircling collar, as is the usual commercial practice. The latter method, in conjunction with a socket split three or four ways, gives a wider adaptability to enable the fitting to grip pipes of slightly varying sizes. But there is no reason why this should be necessary in the present case; if the carburettor is bored to fit the induction pipe properly in the first place, only the merest contraction of the clamp is necessary to secure it immovably, and it is far more likely to produce an airtight joint than if it has to accommodate itself to a pipe three or four thousandths of an inch below specified size.

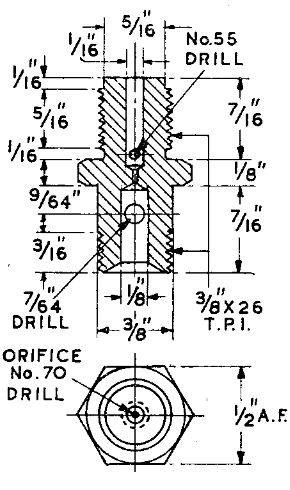
For machining the plunger barrel, the casting may be clamped to an angle-plate on the faceplate, the intake flange affording a true reference sur-



Details of float chamber

face, and also a footing for a clamp on each side. Square up the barrel by sighting from a square held against the faceplate, and set it to run truly over the outside. It may then be faced, centre-drilled and bored ; if true drilling can be ensured, a $\frac{5}{16}$-in. drill can be run right through to form the tapping hole in the base. The bore for the plunger should be finished as smoothly as possible, one of the best tools for this purpose being a carefully-honed D-bit, used with paraffin lubricant, and not removing more than two or three "thous." ; this has a slight burnishing effect, which will not only polish the bore, but also work-harden it.

At the same setting, the outside surface at the top end of the barrel can be turned and screw-cut to receive the cap. The base can be machined by making a pin mandrel, a wringing fit for the bore of the barrel. After facing the end, the tapping hole is skimmed out to slightly under 11/32 in., and counterbored 13/32 in. at the end for a depth of $\frac{1}{16}$ in., then tapped $\frac{3}{8}$ in. by 26 t.p.i.,



Jet housing

or the nearest convenient *fine* thread pitch. (The threads recommended in all cases are standard brass pipe pitches.)

In slitting the clamp lug, take care that the saw-cut does not go right to the bottom of the socket, or a permanent air leak will be produced which may play havoc with good carburation. The air bleed hole is drilled at an angle of 30 deg. to the barrel axis ; this is not critical, but the hole should emerge in the clearance recess of the tapped hole and not encroach too much on the joint face. Note that the top of this hole is plugged with a screw, and a No. 60 hole is drilled in the side to form the entry to the air bleed passage. In this position, the risk of it becoming clogged with dirt is minimised. The three tapped holes for the screws securing the air cleaner can be left for the present, as they can be spotted from those in the latter component.

Float Chamber

This may be held by the base end for facing the top and boring the inside, the base hole being drilled through also at this setting if convenient. It is then reversed, preferably by mounting on a stub, for facing off the base. The casting is then mounted eccentrically on the faceplate for machining the "banjo" ; the top surface forms a convenient mounting surface, and it may be securely held by a single bolt through the centre, or an external bolt and clamp ; in the latter case, care must be taken to avoid bruising the machined base joint face. Set the centre of the banjo to run truly, for facing, centre-drilling, undersize drilling, and boring out. It may be found necessary to make or adapt a special internal recessing tool for chambering out the inside of the banjo. If a cutter bar not larger than $\frac{3}{8}$ in. dia. is available, the top face of the banjo may also be machined at this setting, by passing it through the hole and fitting a left-hand side cutter. This saves re-mounting the work in the reverse position, which is liable to involve some risk of getting the top face out of parallel with the bottom. The cross hole is then drilled through into the float chamber, its outer end being spot-faced and tapped for the plug-screw.

If it is decided to fabricate the float chamber, the method employed in the "Atom" Type R carburettor, namely, the use of a separate banjo, screwed into a thickned boss on the chamber and lock-nutted, will save a good deal of work, and also provide a means of adjusting the angle of the float chamber, if this should be desirable.

Jet Housing

This is preferably made from hexagonal brass bar, but round bar may be substituted, if flats are formed for screwing it up. The upper end should be machined first, and the $\frac{1}{16}$ in. hole drilled, with care to ensure that it is true, and the thread, which should either be screwcut or screwed with a tailstock dieholder, should on no account be a slack fit in the base of the body.

Note the undercut at the shoulder, which is most important, not only to ensure that the component goes fully home, but also to give a free air passage for the air bleed to the cross hole immediately above the orifice.

The lower end may be machined by holding it in a tapped nut or odd piece of stock, to ensure truth and freedom from damage. In the absence of any special fine-drilling appliance, the jet orifice can be drilled quite easily by holding the drill in a small pin-chuck and applying it *by hand* while the lathe is running at top speed. The exact size of the hole is not of critical importance, and if no suitable twist drill is available, it is possible to make one from a sewing needle by a little patient honing, and the aid of a magnifying lens.

For the benefit of those who wish to use a plain jet, or a type of variable jet which is not externally accessible, I propose later to describe modifications to this and other minor components, but the type shown conforms to the assembly shown in the general arrangement drawings.

(To be continued)

*MAKING SMALL FOUNDRY PATTERNS

by E. W. Twining

FIG. 6 is a longitudinal section of a piston-valved cylinder with a cross section through the front steam port. Both ports are straight, but are raked inwards a little from the cylinder ends to the valve-chest, so that they can be readily accessible, from the open ends of the cylinder, for cleaning up with suitable small files. This makes a far better arrangement than wire-drawing the steam, and especially the exhaust, through a number of drilled holes, which is the usual way of forming inlet and outlet ports in model cylinders.

Though not a part of the pattern work I might mention that in the cylinder shown in Fig. 6 the exhaust pipe is silver-soldered together and either flanged and screwed on to, or soft-soldered into, the ends of the valve-chest. The valve-chest liner is either a steel tube, forced in, or a brass tube, soldered in. The solid piston-valve, of hard brass rod, with no rings, is lapped into the tube after the liner is in place. The ports, cut through the liner, need have, with ringless valves, only three bridges and these can be quite narrow, so as to leave as free a passage as possible for steam and exhaust.

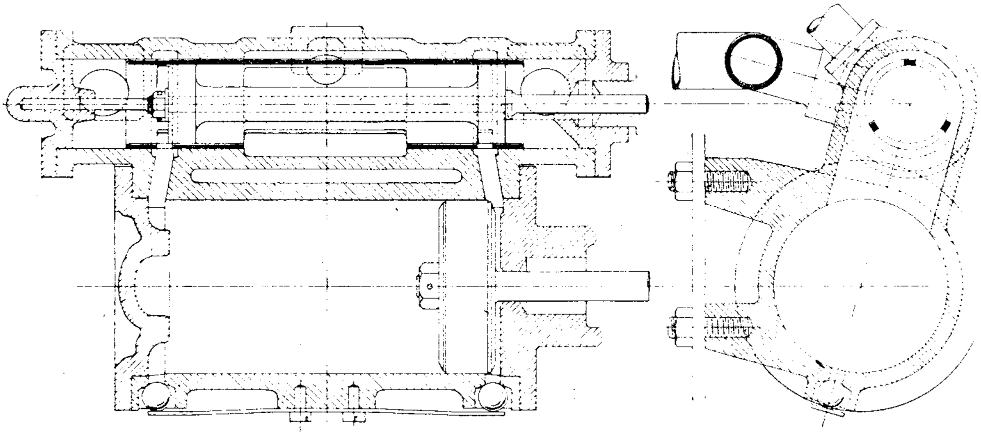


Fig. 6. An outside cylinder with piston valves

Two cores will be used in moulding but only one corebox need be made, that for the valve-chest with the steam ports attached. A drawing of one half of this box is included in Fig. 7. For coring the cylinder itself the moulder will use a standard cylindrical core and all that the model maker—or pattern maker—need do is to turn the body of the cylinder with prints of a definite inch and fractional inch diameter at each end. In Fig. 7 is shown at *A* and *A*1 in elevation, the pattern with prints for the cylinder and valve-chest. *B* is one half of the valve chest corebox and *B*1 a cross section through both halves at one of the ports. At *C* is an end elevation for an alternative for a larger cylinder in which additional coring is called for, the extra cores being stippled in the drawing. Coreboxes will be needed and the object of these cores is to reduce the amount of metal and produce flanges for bolting the cylinder to the engine frame instead of using studs or set-screws. In both *A*1 and *C* the parting line in the sand is marked, *PL*.

*Continued from page 62 "M.E." July 10th, 1952.

The reader may be surprised to see the suggestion that lapped piston valves be used, but I can assure him that such valves, with proper lubrication, will remain steam tight for a very long time. I once ran a 15 h.p. "White" steam car, the engine of which—a two-cylinder compound—using steam superheated and at 600 lb. pressure, had solid piston-valves in both valve-chests and both lapped in, with no rings. When the car was about ten years old, I took the engine down; I found that the high pressure-valve only was somewhat pitted, the low pressure being still perfect; by the way, the valves were of cast-iron on steel spindles and worked in plain cast-iron chests with no liners and no port bridges.

I rebored the H.P. valve chest, made a new valve, lapped it in and gave the engine a new lease of life. Eventually the car failed in other respects and I sold it to a man who used the engine and steam generator in a launch. The valve-gear was Joy's.

Before passing on from the cylinder, which is the subject of Fig. 6, I might call attention to the ball-valves shown at the bottom of the cylinder

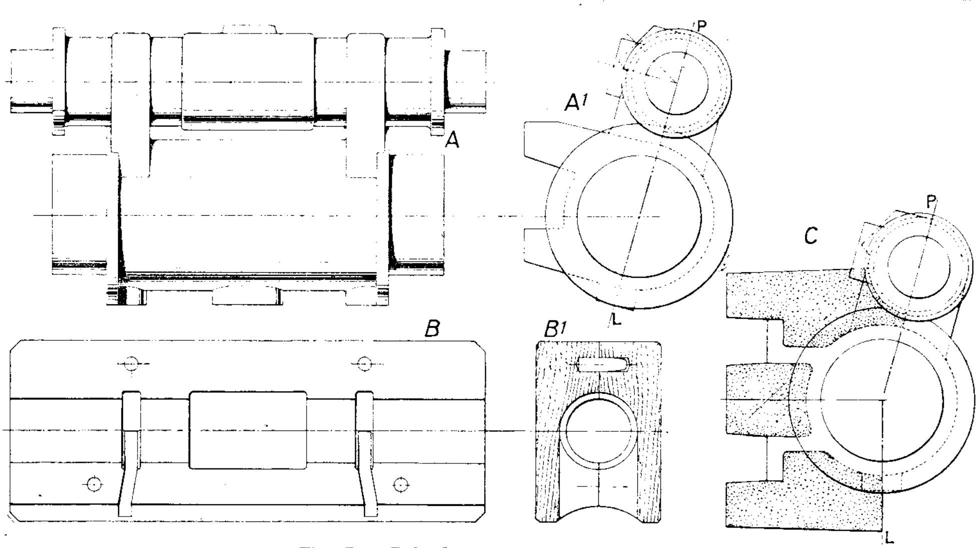


Fig. 7. Cylinder pattern, corebox, etc.

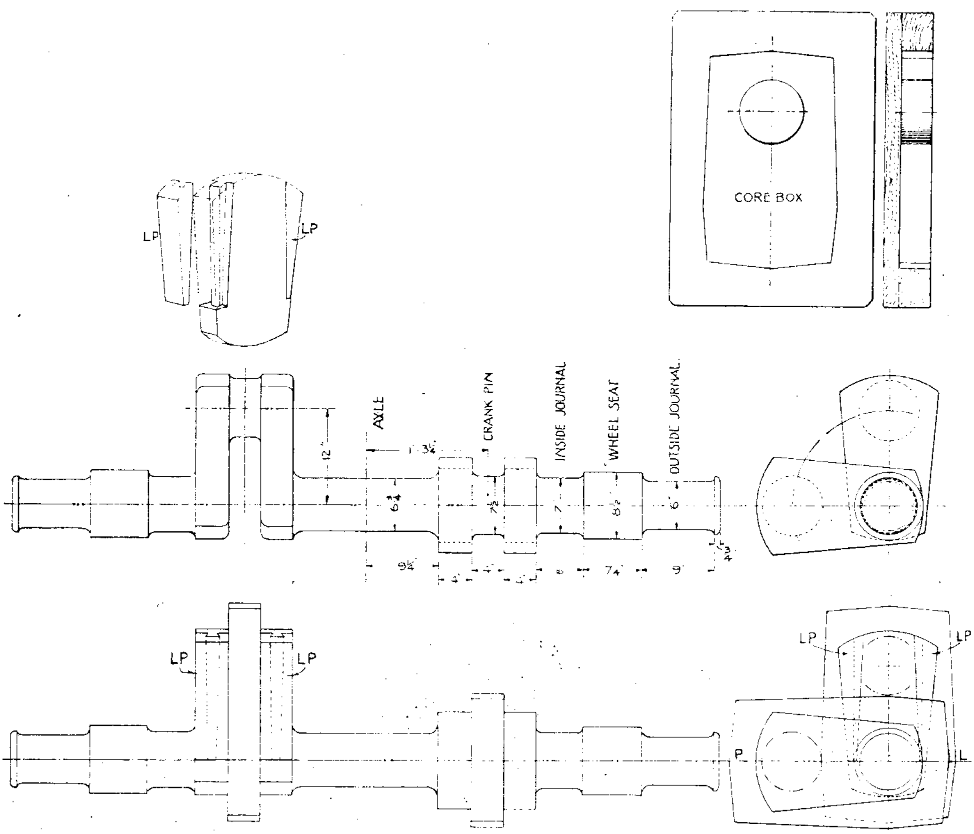


Fig. 8. A cranked axle in cast-steel or M.C.I.

in the position usually occupied by blow-off cocks. The balls are loaded, by a single-leaf spring, to just a little above boiler pressure and lift automatically, for the relief of condensate. Relief-valves are essential with piston-valves, since these cannot come off their seats under water pressure as can ordinary slide-valves.

Now I want to say something about—and illustrate—the use of loose pieces on foundry patterns. The practice of fitting such pieces is quite common in engineering and foundry work generally, both large and small. It can sometimes be a somewhat complicated business, which may involve unscrewing and removing portions of the pattern by the moulder before he can clear it from the sand, but as this applies chiefly to large work I will confine my description to simple sliding pieces which meet all contingencies in model making.

The necessity for fitting detachable parts is brought about by the impossibility of extracting a pattern from the sand in the moulding box by reason of its shape, unless, when the moulder lifts the pattern out of the sand, or lifts the upper half of the box and mould off the pattern, some part of the pattern is so made that it is left behind in the sand, to be afterwards picked out by the moulder.

I give here drawings of two examples ; the first, Fig. 8, is a locomotive cranked axle ; this was actually made, some years ago, to a scale of one-and-a-half-inch to one foot for a model of a Great Western engine of the 157-166 class, a 2-2-2-type with 7 ft. driving wheels and double, i.e. inside and outside frames.

The axle was to have been in cast-steel, carefully annealed, but it was afterwards decided to use malleable cast-iron, which for model work, especially where four bearings are provided, is quite sufficiently stiff. Fig. 8 shows, at the top, the full size axle, longitudinal and end views. Now the reader will see that if the pattern for the model had been made exactly like the prototype it would not have been possible to extract it from the sand, so the use of loose pieces was resorted to and the moulding was done with *PL* as the parting line between the lower and upper boxes. The spaces between the crank-webs were provided for by cores, produced by one corebox only for both cranks. To enable the tapered crank-webs, upstanding from the parting line, to leave the sand the sides of the webs—all four of them—were fitted with sliding loose pieces dovetailed in. Although the whole pattern was well coated with shellac varnish the faces of the dovetailed pieces and the webs were given one thin coat only and when this was quite dry the sliding surfaces were rubbed hard with a blacklead pencil to ensure that they would slide with perfect freedom. When the upper box was lifted the four loose pieces went up with it ; the moulder then turned the box over and, with a pair of tweezers carefully drew each piece out of the sand.

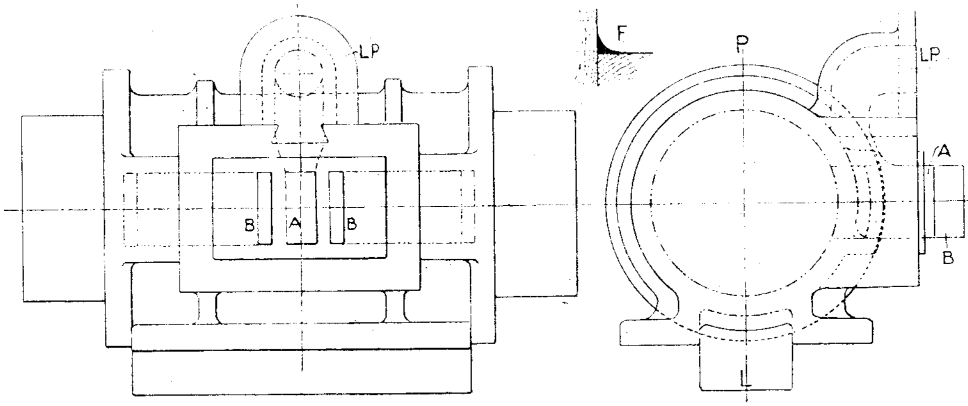


Fig. 9. A pattern for a cylinder with a loose piece

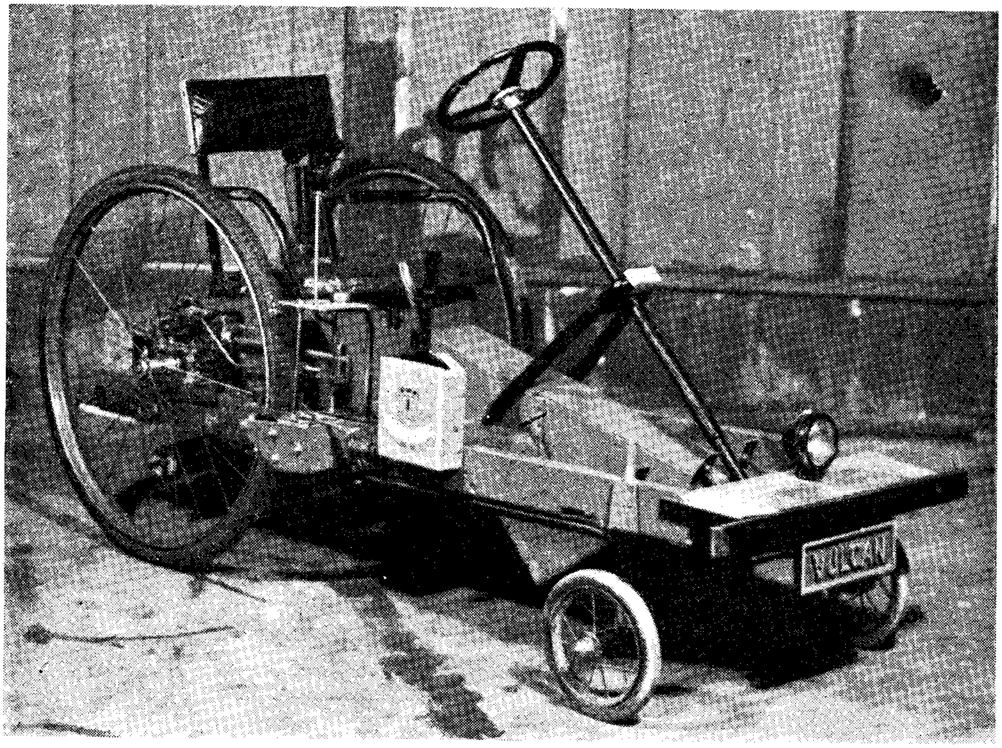
The other example : Fig. 9, is not locomotive work ; it is a cylinder for a model of a horizontal steam engine in which the exhaust pipe is taken out in the same direction as the steam pipe comes in, namely through the wall of the engine room. Here again, were the pattern made in one piece it could not be extracted from the sand, so, we part, in moulding, on the vertical centre-line *PL*, which will of course be horizontal in the sand, and make the exhaust outlet, with its flange, a loose piece. Now although the exhaust port core terminates at the flange face, where I have put the letters *LP* in the end elevation, we cannot have a print here, otherwise such print would prevent the withdrawal of the loose piece ; furthermore we cannot put a very deep print at *A*, on the port face, where the slide-valve travels, for if we did it would not be possible to get the core into it. Nevertheless the exhaust core will be found to have a sufficiently long extension to drop into *A*, and ensure that it is central with the exhaust pipe outlet. At this point, *LP* the core will have a flat end and this should enable it to stand upon the face of the sand quite square and true.

The steam-ports prints *B*, should project very much more than *A* for the impressions left by these will have, to some extent, to support the long cores which go to the cylinder ends.

(*Continued on page* 90)

The "Vulcan" Mark III Car

by J. A. K. Laidlaw



THE Mark II version of "Vulcan" was described in THE MODEL ENGINEER of July 26th, 1951, and those who read the article will remember that she was, at that time, a very primitive vehicle—no brakes, no springs, and "rope and broomhandle" steering gear!

Steering is now effected through a pinion and quadrant gear (both pinion and quadrant, and most of the gearbox being derived from a bomb-sight computor), and independent front suspension has been fitted. In order to get as large an angle of lock as possible, the track-rod is in front of the stub axles.

Brakes are fitted on the rear wheels only; as most of the weight is on the rear wheels, this does not lead to much loss of brake power. The casing between the two foot wells contains the rod connecting the brake pedal to a crank on the brake cross shaft. Two smaller cranks, at the ends of this cross shaft, are linked to the brake horse-shoes which carry ordinary bicycle brake shoes and blocks. A short length of bicycle chain connects the right-hand brake crank to the hand brake lever.

Under the seat is a small locker for tools. It also contains a holder for the headlamp battery.

Behind the seat we have the engine and transmission which are mounted on a sliding board, moved by two screws, to allow for adjustment of the driving chain.

The engine is the Channel Islands special, a 10 c.c. petrol engine ($\frac{1}{2}$ h.p.), which was converted from air to water cooling by removing all the fins from the cylinder barrel, except those at top and bottom, and soldering on a water jacket made from a length of steel tube. When the water jacket was first fitted, copper pipe was used, but the difference in the expansions of the cast-iron and copper was too much for the solder and leaks appeared with distressing frequency. The radiator can be seen attached to the back rest of the seat.

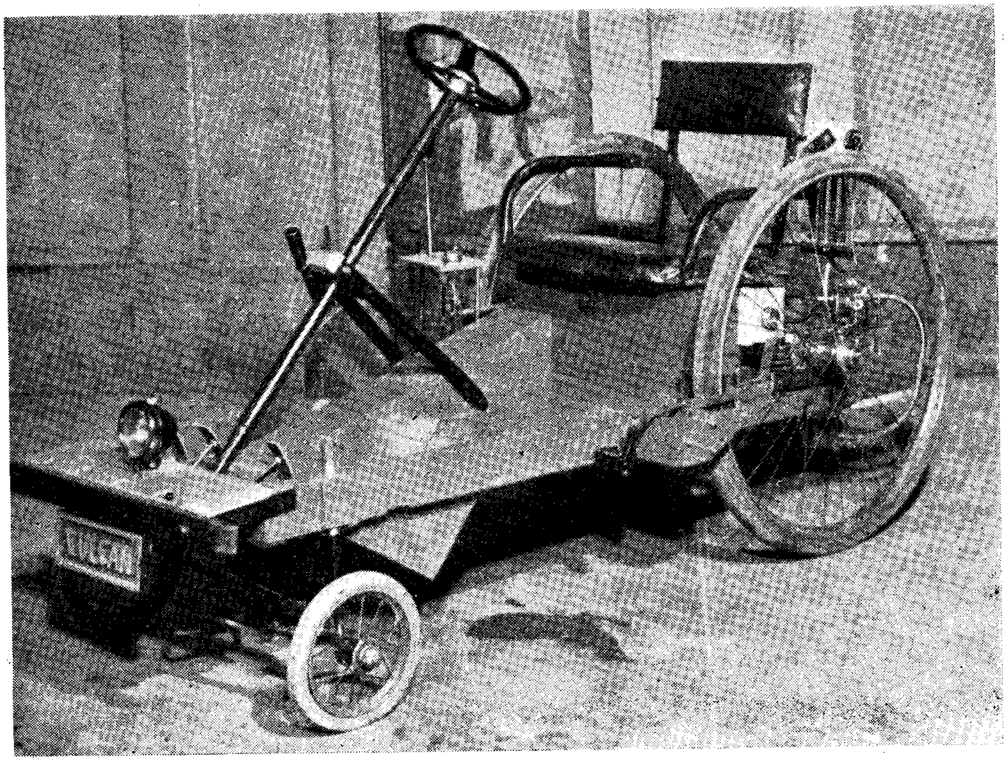
The clutch casing started life as the exterior of a bicycle speedometer. It is mounted on a spigot, running in ball-bearings which are housed in one of the gearbox endplates. Besides forming a bearing for the clutch casing, the clutch shaft and the gearbox mainshaft, this spigot carries one of the gearbox constant mesh wheels. In normal automobile practice the engine flywheel forms part of the clutch, but this is in no way a normal automobile, and, apart from the

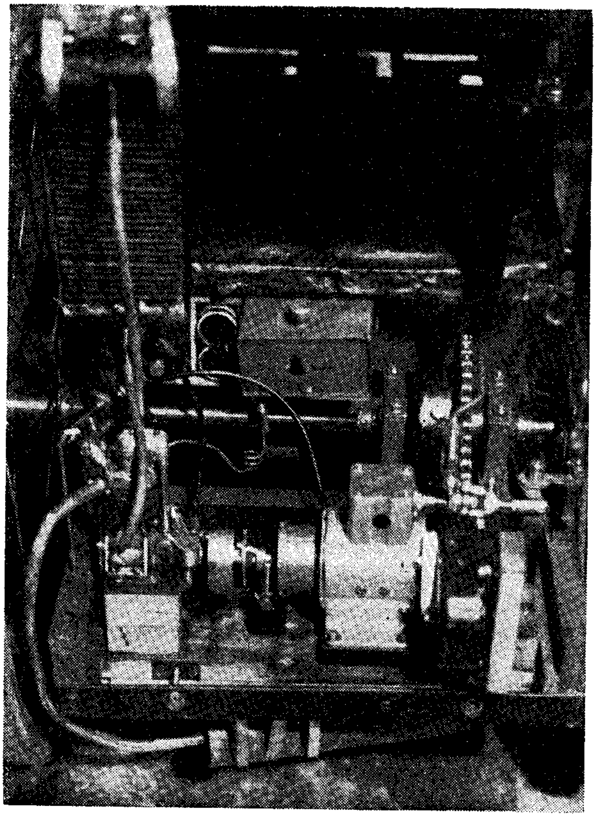
convenience of having the engine and transmission in separate units, a special engine flywheel would have been required. Those unfortunate model engineers who have no lathe and are compelled to get parts turned (at fabulous prices), will appreciate the necessity for the adoption of such bits and pieces as are available. The clutch has a single dry, cork lined plate with a central pressure spring. Withdrawal is by direct compression of the spring through a thrust-race, no toggle levers being required in a clutch of this size. At first this clutch was extremely fierce, so fierce that there appeared to be no point in the pedal travel at which the plate slipped ; it was either in or out. This was cured by making the pedal travel as far as possible, while the clutch withdrawal lever travelled just far enough to disengage the clutch. Although a few of the gearbox parts were specially turned (at the above-mentioned fabulous cost), most of the clutch parts were turned on the " Wolf Cub " woodworking lathe, using a watchmaker's graver. All parts turned in this way are either aluminium or brass with the exception of the clutch casing which is of zinc base alloy.

The gearbox casing will be recognised (possibly !) as the exterior of a repeater motor with the addition of a selector box which was originally part of a hand limit control box. This box gives three speeds forward and reverse, all the gears being in constant mesh. Gear engagement is by means of dog clutches which stand up to more misuse than the gear teeth, and give easier engagement than the gears themselves. Overall gear ratios, from crankshaft to back axle, are first, 300 : 1, second, 169.4 : 1, top, 93.6 : 1. Reverse is a slightly higher ratio than first. These very low ratios are necessitated partly by the high engine revolutions and partly by the size of the rear wheels.

The final reduction gear is an *ex*-Air Ministry winch, the hand wheel from which now does duty as the steering wheel. In place of the cable driving wheel, this winch is now fitted with a 13-tooth chain sprocket and is driven from the gearbox through an 8 : 1 reduction gear. The clutch, gearbox and reduction gear are built as a unit with all gears enclosed, and the engine drives the clutch through a rubber-cushioned coupling. The back axle is carried on a frame riveted up from 1 in. $\times$ 1 in. angle iron and carried on four compression springs. The two half shafts run in ball-races at their outer ends and plain bearings at their inner ends ; the differential casing runs on plain bearings on the half shafts. The differential gears were intended by the makers for use in small hand drills and the casing once covered the mechanism of a Bosch electric horn. A 36-tooth bicycle chain wheel bolted to one side of this casing takes the drive from the reduction gear sprocket. There are only two bevel pinions in the differential mechanism and these are carried on a cross shaft bolted to the casing.

Remote control for the gear change was necessary and this is effected by a system of rods and cranks that Heath Robinson himself might have envied.





It is necessary to rev. up a fair amount in each gear in order to engage the next, owing to the wide ratios employed. These ratios were decided by the gears themselves, because three pairs of gears had to be found which, while having the same distances between the centres and suitably sized holes, would give three different and usable ratios. Surprisingly enough, these requirements were all met from bombsight computor gears. Double de-clutching is necessary when changing down ; any attempt at "cog swapping" without this precaution causes the gearbox to protest in no uncertain manner.

All gears which had to be fixed to their shafts were secured by soft solder. Previous experience with "Vulcan" Marks I and II has shown that pins, if used, have to be of hard steel to prevent shearing, and also the holes weaken the shaft—often fatally. As the shafts are mostly $\frac{3}{16}$ in. diameter and a $\frac{1}{16}$ in. pin is the minimum that will stand the strain, it will be seen why solder was used. The ends of the gears are deeply countersunk to provide as large a holding surface as possible for the solder, and the only two failures to date have been due to faulty soldering and the initial ferocity of the clutch.

Needless to say, "Vulcan" is not intended as a road vehicle, but for anyone who has no space in his garden for a locomotive track and wants to build a drivable vehicle, something of this sort is ideal. It is, at least, out of that rut into which so many readers complain we are falling.

MAKING SMALL FOUNDRY PATTERNS

(*Continued from page* 87)

Provision ought to be made, in the corebox for the cylinder bore, for recesses to be formed in the core, into which recesses the ends of the port cores will fit and where the moulder will probably cement them. One corebox will suffice for both steam port cores.

Just a few words regarding the finish of patterns. All outer angles can be left sharp, but inner angles should be neatly rounded off with a fillet, excepting, of course, where prints join on to the main pattern. Such fillets in large patterns are often formed by strips of leather of triangular section, sometimes by slender sticks of wood, shaped by pulling through a drawplate, but in model makers' patterns the simplest way is to fill the angle with a mixture of whiting, or plaster with thin glue ; "Barbola" paste is excellent for the purpose. The angle is first painted with glue, the paste is rolled to a thin rod, pressed into place and neatly radiused with a round-ended and polished brass rod, or by rolling a bicycle ball. Superfluous paste squeezed out is removed by scraping off with a knife edged, or chisel-shaped slip of wood. A section of such a fillet is added at *F* in Fig. 9.

With regard to the glue used in pattern-making ; this ought to be of the waterproof kind but it is quite in order to use the ordinary "Scotch" kind, or "Seccotine," provided that every trace that squeezes out from a joint, is removed with a wet rag or brush. The best adhesive for small patterns is the celluloid cement which is used by aero-modellists for sticking balsa wood together. Where possible all joints should be pinned as well as glued.

Many professional pattern makers paint their work with a pigment mixed with shellac varnish ; some use chrome yellow, others red lead or vermilion, but all, or nearly all, paint the prints for cores black.

Personally, I much prefer to see the grain of the mahogany through about three coats of clear shellac ; there is then no chance of shoddy work being covered up, such as the filling up of cracks and bad joints, with plaster. Prints should always be black and the insides of core-boxes treated the same. "Spirit black" is the best, not a pigment, dissolved in shellac.

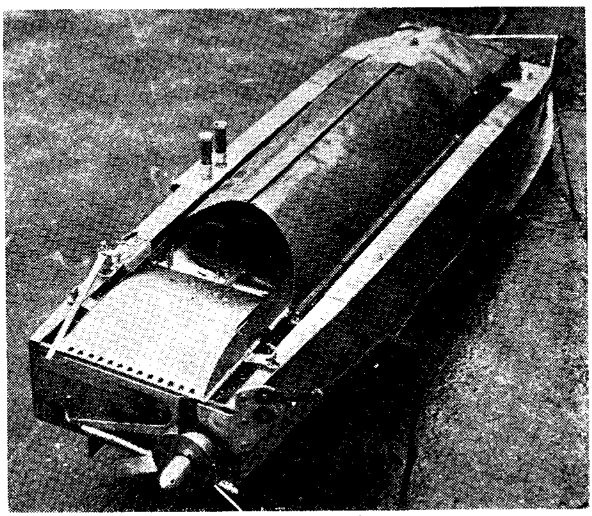
Model Power Boat News

by "Meridian"

The International and Blackheath Regattas

THE weather this year has not been very kind to power boat men. Several regattas in succession have been subjected to the handicap of rain, and while no event has been abandoned, it is obvious that performances must be affected.

Internal combustion engines in particular, are affected by damp atmospheric conditions, and several exponents have reported that jet settings seem to alter very considerably on a wet day. The widespread use of alcohol fuels may have something to do with this trouble, as alcohol absorbs water from the atmosphere very readily. Certainly, stalling of the engine and petering-out after a few laps, are troubles that are always much more prevalent on a damp regatta day.



Mr. B. J. Pilliner's "A" class flash steamer "Frolic" which embodies many daring and original features of design

M.P.B.A. International Regatta

No competitors from abroad were forthcoming at this regatta, but Monsieur Suzor has arranged to attend the Hispano-Suiza event, to be held later in the year.

Entries were numerous, well over 40 hydroplanes contesting the four races. Several competitors were "timed off" on the 3-min. starting period allowed, so that some boats did not actually run on either attempt. This is a pity, but it is evident that the time limit has come to stay, due to the large entries now appearing at almost every regatta.

The racing commenced with the "C" Restricted race for the Wembley Trophy, and there were about a dozen different boats entered.

One of the earlier competitors. C. Hancox (S. London) put up a good run at 48.5 m.p.h. with a new boat, *Lady Joan*, but this was not enough to beat the speed of S. Poyser's *Rumpus* 3 which attained 53.2 m.p.h., thus retaining the trophy for the second year in succession. Other competitors had various starting or capsizing difficulties, and it was left to Mr. Poyser (senior) to take third place with *Rumpus* 5.

Good clean runs were made by Messrs. K. Hyder (Victoria), J. Princhin (Blackheath) and E. Woodley (Victoria), but not at the speeds usually attained.

The next event was the Miniature Speed Championship for Class "B" boats, and the number of entries was higher than usual. The "B" class is, for some unknown reason, the least well supported of the racing classes, and this is rather surprising, since there are many points in favour of the 15 c.c. engine, as against the 10 c.c. and 30 c.c. varieties.

G. Lines (Orpington), with *Sparky II*, easily retained this trophy, putting up the best speed of the day in any class—59.1 m.p.h. for the 5 laps.

F. Jutton, with the flash steamer *Vesta III*, still has the slowing trouble that has been apparent since the change of hulls, but completed the course at about 35 m.p.h.

R. Mitchell (Runcorn), with *Beta II*, made two faultless runs at around 45 m.p.h., but this speed was exceeded by two other competitors, A. Rose (Coventry) and R. Cluse (Orpington), both with new boats. Mr. Rose's boat is a nicely streamlined job, fitted with a four-stroke engine, and 49.1 m.p.h. was attained. Mr. R. Cluse, with the two-stroke engined *Crack-o'-Dawn* 2 recorded 46 m.p.h., and these two runs took second and third places respectively.

Towards the end of this race, a drizzle of rain commenced, and this continued throughout the rest of the day, becoming heavier as time progressed.

A short lunch interval was taken before the Class "C" boats came on for the Wico-Pacy Cup race. In spite of the rain, only two boats out of a total entry of twelve failed to return a time,

although speeds were lower than expected.

Again the holder of the trophy was successful in retaining it. L. Pinder, with *Rednip* 7, attained 48.1 m.p.h. for the 5 laps, and at the finish no one had bettered this performance. C. Stanworth (Senr.) (Bournville) with *May*, and R. Mitchell (Runcorn), with *Gamma*, took second and third places; the respective speeds were 47.7 and 43.3 m.p.h.

The International Trophy race for the Class "A" boats was disappointing in some respects,

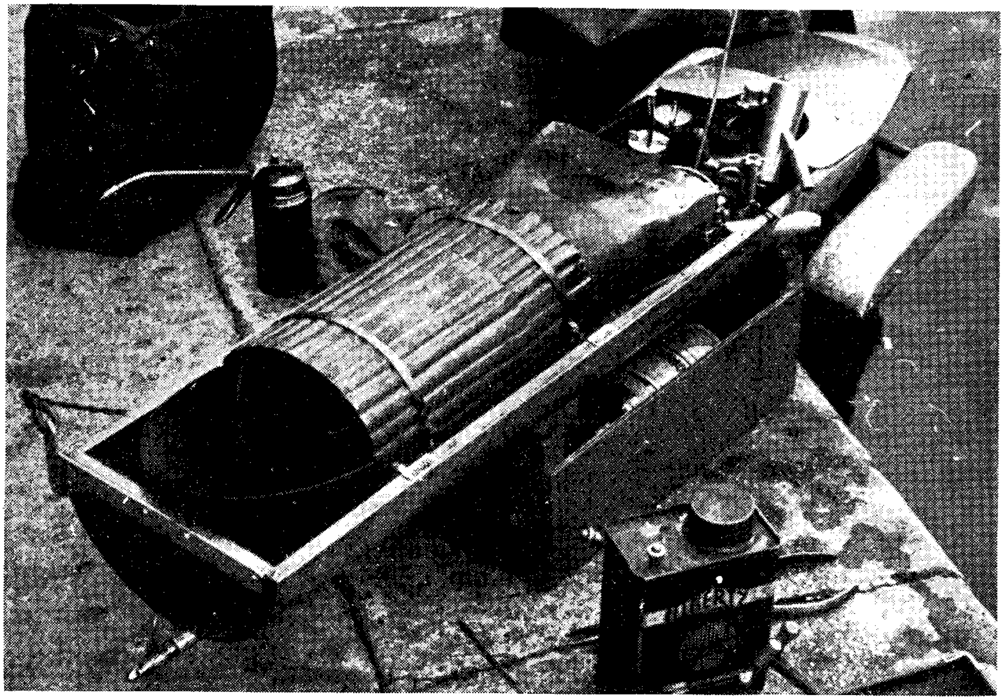
3. H. Poyser (Victoria), *Rumpus* 5: 43.1 m.p.h.

500 yd. Class "B" Race for the Miniature Speed Championship

1. G. Lines (Orpington), *Sparky* 2: 59.1 m.p.h.

2. J. Rose (Coventry), *Meteor I*: 49.1 m.p.h.

3. R. Chse (Orpington), *Crack-o'-Dawn* 2: 46 m.p.h.



Mr. F. Jutton's "B" class flash steamer "Vesta III" which also shows originality in both hull and engine design

although it must be admitted that this race had the worst of the weather. There were twelve entries in all, including such well-known boats as *Gordon* 2, *Big Sparky*, and *Betty*. At the end of the first "round" only three boats had completed the course, the best speed being 43.1 m.p.h. by K. William's *Faro*.

The first boat to make the second run was J. H. Benson's *Orthon* (Blackheath), and a run at 47.5 m.p.h. was completed. No other boat could better this speed, but S. H. Clifford's *Blue Streak* attained 44 m.p.h., which took second place. B. Pillinor's spectacular flash steamer *Frolic* (Southampton) had to be withdrawn after unsuccessful efforts to start.

Results

500 yd. "C" Restricted Race for the Wembley Trophy

1. S. Poyser (Victoria), *Rumpus* 3: 53.2 m.p.h.

2. C. Hancox (S. London) *Lady Joan*: 48.5 m.p.h.

500 yd. Class "C" Race for the Wico-Pacy Cup

1. L. Pinder (Kingsmere), *Rednip* 7: 48.1 m.p.h.

2. C. Stanworth (Senr.) (Bournville), *May*: 47.7 m.p.h.

3. R. Mitchell (Runcorn), *Gamma*: 43.3 m.p.h.

500 yd. Class "A" Race for the International Trophy

1. J. Benson (Blackheath), *Orthon*: 47.5 m.p.h.

2. S. Clifford (Victoria), *Blue Streak*: 44 m.p.h.

3. K. Williams (Bournville), *Faro*: 43.1 m.p.h.

Blackheath M.P.B.C. Regatta

The Blackheath club held their first open regatta in 1946, and it has become an annual event that is very well supported by both London and Provincial Clubs.

This year's regatta, held a week after the International, attracted the largest entry ever, no less than 35 steering boats and 31 hydroplanes taking part in the various events. This entry was in spite of a rainy start to the day, which, happily, cleared up in the afternoon.

The Southend M.P.B.C. were present in force, together with several junior members who obviously enjoyed every minute of the day's sport. One of these, D. Aldridge, was successful in winning the nomination event with *The Jay*, a small diesel-engined launch.

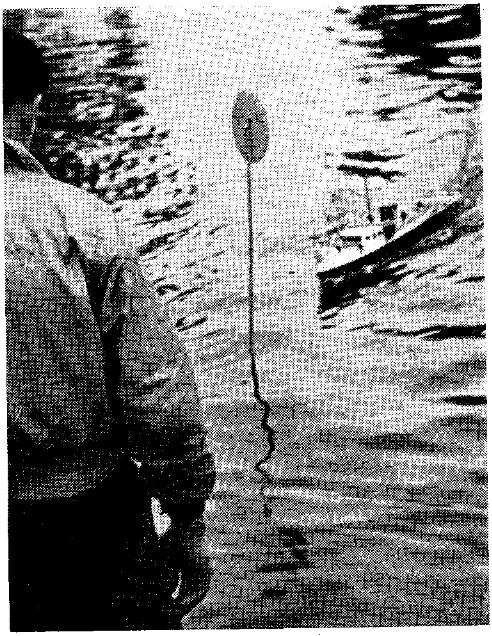
The Blackheath steering course again proved a difficult one, the best score being 9 points by B. Squires (Kingsmere) with *Comet III*. Three competitors, Messrs. Vanner, Slender and Falconer tied for second place and final placings were second, E. Vanner, third J. Slender.

Some good speeds were recorded in the hydroplane events, 60 m.p.h. being exceeded in the Class "A" race. This was by E. Clark's *Gordon II*, which seems back on form again.

In the Class "B" race, F. Jutton's *Vesta III* showed amazing speed on the earlier laps, and it may be hoped that the "slowing down" troubles may be overcome in the near future.

Another flash steamer, B. Pillinor's *Frolic* (Southampton) did some aerobatics when a "flip" occurred during the Class "A" race. Unfortunately, damage was sustained which prevented a second run.

Mr. E. A. Walker starting his "A" class boat "Boxotrix" at Blackheath



Mr. Squire's "Comet III" scoring a bull in the steering competition

Results

50 yd. Nomination Race.

1. D. Aldridge (Southend), *The Jay* : 1 sec. error.
2. A. Falconer (Blackheath), *Golden Marid* : 1 sec. error.
3. P. Cleary (*Blackheath*), *Urchin* : 1 sec. error.

(Results by per cent. error)

300 yd. "C" Restricted Race.

1. W. Everett (Victoria), *Ann* : 57.9 m.p.h.
2. S. Poyser (Victoria), *Rumpus* 3 : 53.1 m.p.h.
3. K. Hyder (Victoria), *Slipper I* : 49.5 m.p.h.

300 yd. Class "C" Race

1. B. Miles (Kingsmere), *Dragonfly* 3 : 58.2 m.p.h.
2. L. Pinder (Kingsmere), *Rednip* 7 : 39.7 m.p.h.

Steering Competition

1. B. Squires (Kingsmere), *Comet III* : 9 pts.
2. E. Vanner (Victoria), *Leda III* : 8 pts. + 5
3. J. Slender (Welling), *Sarah Ann* : 8 pts. + 3

500 yd. Class "B" Race

1. G. Lines (Orpington), *Sparky II* : 53.27 m.p.h.
2. F. Jutton (Guildford), *Vesta III* : 43.6 m.p.h.
3. M. de B. Daly (Blackheath), *Nipper* : 40.1 m.p.h.

500 yd. Class "A" Race

1. E. Clark (Victoria), *Gordon II* : 61.2 m.p.h.
2. G. Lines (Orpington), *Big Sparky* : 54.9 m.p.h.
3. J. Benson (Blackheath), *Orthon*: 51.1 m.p.h.

Drilling and Tapping a Square Column

THERE is usually no difficulty in drilling round material axially in the lathe, for short lengths can be accurately centred in the four-jaw chuck, and then drilled and tapped from the tailstock.

If the overhang of a long shaft is excessive, the outer end can be supported centrally in the fixed steady for facing, drilling and tapping the shaft end. In the same way, a short length of square material is easily dealt with, but the ordinary fixed steady cannot be applied directly to a long, square shaft when the outer end needs additional support.

To overcome this difficulty, the square bar can be secured to the lathe saddle, and the feed is then obtained by traversing the saddle by means of the leadscrew. After the ends of the bar have been filed square, a centre is marked out, at either end with the jenny callipers, as shown in Fig. 1; next, these centres are deeply marked with a centre punch, taking care to hold the punch upright and to keep the centre exactly in the middle of the scribed square. The two lathe centres are now fitted in place and the bar is supported on its centres between them.

The saddle is next moved to bring the clamping surface of the topslide directly under the bar, and the cross-slide is then locked. In lathes of some $3\frac{1}{2}$ in. centre height there is usually enough head room to accommodate a $\frac{3}{4}$-in. square bar, and where necessary, a packing strip is inserted between the work and bolting surface of the topslide.

After lightly tightening the nut on the tool clamp plate, withdraw the tailstock, and move the saddle back so that the work is clear of the mandrel centre. Tighten the clamp-nut a little more, and then test the alignment of the centre marks against the lathe centres. Do not tighten the clamp-nut with the work supported by the centres, as this may cause damage if the packing is not of the correct thickness. Make a final test with the bar securely clamped, and with the cross-slide locked.

Incidentally, the Drummond lathe is fitted with a box-form toolholder, which is readily adjustable for height, and will take square bars up to $\frac{9}{16}$ in.

It may happen that the column is too long to go between the lathe centres; if so, remove the tailstock, and pack up the work in the tool clamp, until the mandrel centre will engage in the forward punch mark. Next, set the bar on the lathe axis by means of a try-square resting on the lathe face-plate, or the test indicator may be used for this purpose.

Square bars larger than $\frac{3}{4}$ in. will usually have to be mounted on the cross-slide, in order to set them at centre height. There are several ways in common use of doing this.

A specially-made toolpost, of the kind illustrated in Fig. 2, can be mounted directly on the cross-slide, and the work is then secured in place under the tool clamp. A more convenient way, perhaps, is that illustrated in Fig. 3. Here, the work is supported between the lathe centres, and a machine vice is mounted on the cross-slide with the nuts of the holding-down bolts turned only finger-tight. After the vice jaws have been closed to grip the work securely, the holding-down bolts are fully tightened. One

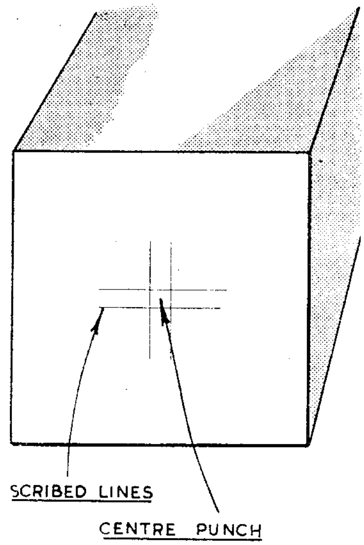


Fig. 1. Marking-out the centres on the bar

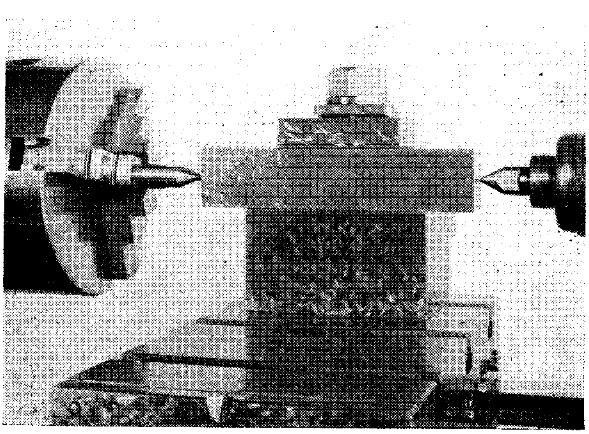


Fig. 2. The work held in a cross-slide toolpost

advantage of having the tailstock in place is that its centre can be kept engaged to stop the work shifting during the subsequent machining operations, and, with this in mind, the bar should always be mounted with as little overhang as possible at the mandrel end.

When the work has been correctly aligned, and securely clamped in place, its end should be machined to provide a flat surface for drilling. For this purpose, a milling cutter or a fly-cutter is mounted in the lathe chuck and, after the reading of the cross-slide index has been noted, the slide is unlocked so that it can be used to feed the work across the cutter. Next, return the cross-slide to its original position and lock it securely.

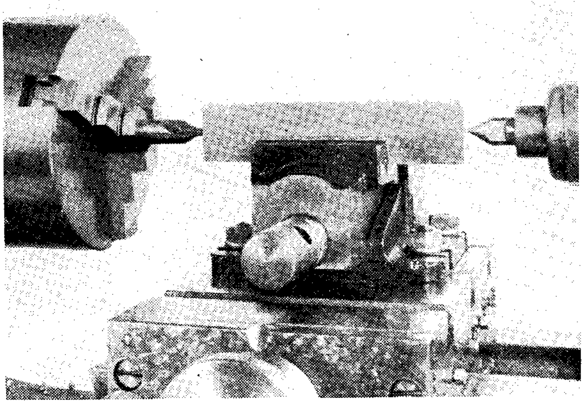


Fig. 3. A machine vice used for mounting the bar on the cross-slide

To start the drilling, mount a centre-drill in the chuck and feed it carefully into the end of the bar by moving the saddle forward. It is advisable to use a centre-drill with a fairly stout pilot portion, for if the chuck does not hold truly, the drill point may be broken off. After a large centre-drill has been put in to form a countersink equal in diameter to the final drilling size, a pilot drill is fed in for the full depth required; this is followed by the tapping-size drill. If the work has later to be reversed for continuing the machining between centres, a sufficiently large countersink should be left in the end of the bar to form a bearing for the tailstock centre.

Be sure to use a drill that will give adequate clearance for the tap, as this will greatly ease the work of tapping.

A taper tap is now mounted in the chuck, and

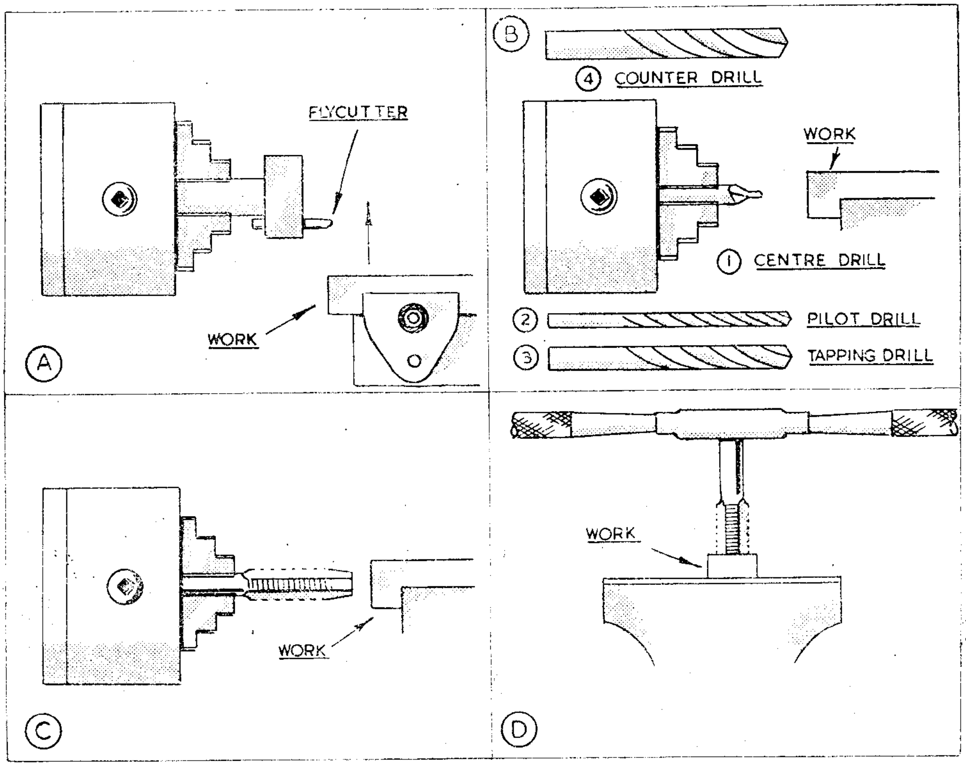


Fig. 4. Sequence of operations for facing, drilling and threading the column

the leadscrew clasp-nut is opened so that the tap can draw the saddle forward.

The tap is turned either by means of a handle attached to the tail of the mandrel, or the chuck itself can be rotated with the chuck key. As the tap enters, move the saddle forward, to keep pace, by pressing lightly on the quick traverse wheel. Should the tap tend to turn in the chuck, do not tighten the jaws too heavily, as this may strain the chuck.

The tap should be kept well supplied with cutting oil and, when it has obtained a good hold and further progress becomes difficult, the work can safely be removed from the lathe with the tap still engaged. To complete the tapping, the bar is gripped in the bench vice, and the taper tap, followed by a plug tap, is put in for the full distance with the aid of a tap wrench.

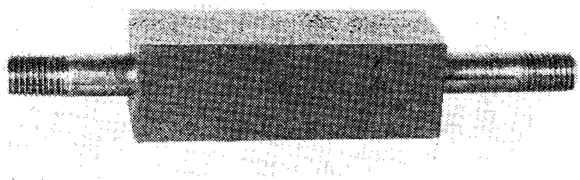


Fig. 5. A square bar machined between centres

Where, as illustrated in Fig. 5, the ends of the work have to be machined, the bar is mounted in the lathe, after being turned end-for-end, for forming the second centre with a centre-drill.

With the work mounted between centres and driven by a lathe carrier, it is now an easy matter to machine either end, in turn, to any required diameter.

PRACTICAL LETTERS

Hipp Electric Clock

DEAR SIR,—With reference to the letter from H. P. Emsley in the June 5th issue, it is possible I can assist him regarding the "thump" he mentions. I have just completed a seconds pendulum Hipp clock, the suspension being by steel ribbon 0.005 in. thick. On occasion the pendulum shudders when taking an impulse and this is due to the trailer arm just not falling clear of the notched block but lodging exactly on the edge and being forced into the notch on the return swing. With his ball-bearing suspension I can imagine this momentary lodging causes a "thump" as there is no flexible spring to ease the shock, as it were. I can suggest no cure for this failing. It would seem that the second wall of the notch needs to comply with the mathematical definition of a line—to have position but no thickness.

Yours faithfully,

Bromley. C. DUDLEY FUKE.

DEAR SIR,—I was interested in the letter from Mr. H. P. Emsley, in June 5th issue of THE MODEL ENGINEER, and also the Query No. 9955 and the reply to same in the issue of May 1st.

Having read Mr. Emsley's letter, I bought a new cycle lamp battery and first of all put it on my clock with the $\frac{3}{4}$ seconds pendulum, and found that the clock ran for one minute ten seconds between each contact. This was with the clock driving the wheelwork and the chime release gear.

The battery was then put on the latest clock, i.e. the one described in recent issues, and it was found to run one minute and thirty-five seconds between contacts. This again includes driving the wheelwork.

I thoroughly endorse the remarks made in the reply to Query No. 9955.

I have also measured the distance between the armatures in both clocks and their corresponding pole-pieces.

In the case of the first clock, i.e. the one with the $\frac{3}{4}$ seconds pendulum, this distance is about 0.030 in., and in the case of the clock with the $\frac{1}{2}$ seconds pendulum, this distance appears to be about 0.035 in. to 0.040 in.

Of course, the number of swings per contact depends on a number of factors, not the least being the condition of the battery and also the gauge of wire used on the magnets.

Yours faithfully,

Winchester. C. R. JONES.

Wood Turning

DEAR SIR,—Recently I was in the neighbourhood of High Wycombe, Bucks, when I took the opportunity of paying a visit to the "Wizard in Wood," who is known for his demonstrations at THE MODEL ENGINEER Exhibition; namely, Mr. F. Pain, of 64, Chairborough Road. Included in an interesting afternoon's programme was a visit to the turner in the woods, where, for my benefit, he cut a log from a tree trunk, split it up with an axe, and from one piece turned a chair leg on a pole lathe. The last operation took about $1\frac{1}{2}$ minutes. From here we went to a large sawmill at Princes Risborough where whole trees were being sliced up, also cutting and shaping down to small discs, then we went on to a modern wood turner where an instructive hour was spent. Altogether, it was a most enjoyable half-day in lovely country, and one which will not soon be forgotten. This is passed on for others who may be interested, for it is understood that Mr. Pain delights in showing the wonders of High Wycombe to members of the model engineering fraternity, to whom I owe a great deal.

Yours faithfully,

London, S.W. J. A. SHERRINGER.

Camera Design

DEAR SIR,—In the article "Camera Design" by Raymond F. Stock, on pp. 208-9 of the issue of February 14th, 1952 (which was brought to my notice by a works colleague) I came across a rather serious error in the diagram of the coincidence type range finder (bottom of p. 209).

In this design, the two negative lenses are at different distances from the positive lens, with the result that the two images would not be of the same size, and that when superimposed would not give true coincidence at any distance.

When using an inverted Galilean telescope for range and/or view finding, the focus of the positive eye lens must coincide with that of the negative objective lens. When, as given in the diagram referred to, two negative lenses are used, *both* their foci must correspond with the focus of the positive lens.

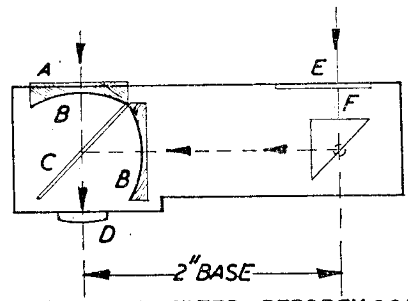
The diagram reproduced herewith shows a method of doing this. The diagram is taken from the plan drawing of a combined range and view finder which I am designing to fit my home-made camera. To avoid crowding the diagram, the lens mounts and prism operating mechanism have been omitted.

For the benefit of any amateur who would like to build his own range finder, may I indicate another snag (and submit a remedy) which may be met.

Unless gold-plated glass is used for the mirror, it will be found that the reflected image is much fainter than the direct one, and the "snap together" of the two images will be difficult to obtain.

The remedy is to dim the direct image until the two images are alike in density, and for this purpose a filter of Perspex 905 neutral should be placed over the direct image negative lens. The addition of a light blue-green filter over the Perspex and a pale orange one over the other window or lens will give greater differentiation between the two images, owing to the use of complementary colours, and a much better "snap-together" when coincidence is obtained.

I hope that Mr. Stock will accept this criticism of an otherwise excellent article in the friendly



A. NEUTRAL FILTER. PERSPEX 905.
B.B. NEGATIVE LENSES. 1" FOCAL LENGTH.
C. MIRROR·010"-·015" THICK. GLASS.
D. POSITIVE LENS. 2" FOCAL LENGTH.
E. WINDOW WITH YELLOW FILTER.
F. PRISM. (SILVER BACK.)
NOTE: PRISM·OPERATING MECHANISM AND LENS MOUNTS OMITTED.

spirit in which it is written, as I feel sure that he, as well as I, would not like a constructor to make up an article from an inaccurate diagram, and then find—too late—that it would not work.

Yours faithfully,
Ipswich. S. WIDDAS.

CLUB ANNOUNCEMENTS

The Brighouse Society of Model and Experimental Engineers

Our public open day, held at our headquarters on June 21st, was unfortunately not as successful as anticipated due to the inclement weather, but we are not grumbling at the attendance in the circumstances, as we hope our exhibition later in the year will be well attended, when we shall not rely as much on the weather.

Over 500 people were entertained at the headquarters, "Ravesnsprings Park," on Saturday, June 21st Several 3½-in. 5-in. and two 7½-in. gauge locomotives were in action hauling visitors around the track. The boating pond was well filled and Dr. Fletcher attracted quite a gathering with his river patrol vessel, which was exhibited at THE MODEL ENGINEER Exhibition in 1938. The load taken aboard as ballast seemed a good pay load for any cargo vessel, but the twin-cylinder petrol engine coped with it all quite successfully.

Headquarters: "Ravensprings Park," Cawcliffe Road, Brighouse.

Edinburgh Society of Model Engineers

In spite of inclement weather, over 30 members and friends paid a visit to the Radar Station, Leith Nautical College, Edinburgh, where, under the capable direction of Commander Moffatt, "Radar" was explained and practical demonstrations given on two sets. We are indebted to Commander Moffatt and Mr. Brooks for arranging this outing.

The next meeting is to be held on Saturday, August 23rd at 3 p.m., at Inverleith Pond, Edinburgh, when the power boat section of the club is giving a show, and all members are requested to attend.

The club is open on Tuesday evenings from 7 p.m., and on Saturday afternoons from 3 p.m. during the summer months, and visitors from other clubs spending holidays in Edinburgh are welcome.

Workshop and clubroom: 1a, Ramsay Lane, Off Lawnmarket, Edinburgh, 1.

Hon. Secretary: JAMES H. FARR, Wardie Garage, Ferry Road, West, Edinburgh, 5. Tel. No. 84176.

Model Power Boat Association

The Hispano Suiza and Ford Trophy regattas will be held at The Lake, Verulamium, St. Albans, Herts, on Saturday, July 26th and Sunday, July 27th, commencing at 2 p.m. on Saturday, and 12 noon on Sunday.

Saturday, July 26th. Hispano Suiza Trophy. 10 c.c. boats.

Sunday, July 27th. Ford Trophy. All classes.

Competitors who have not yet given entries for this event should send them to the hon. secretary. *No entries will be accepted on the day.*

There will be a dinner for competitors and M.P.B.A. members and friends at Batchwood Hall, St. Albans, on Saturday, July 26th, at 8 p.m. Tickets can be bought from the hon. secretary. Applications for tickets must be in by July 19th.

Hon. Secretary: J. H. BENSON, 25, St. Johns Road, Sidcup, Kent. Tel.: Footscray 7428.